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INFORMATION REPORT INFORMATION REPORT

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ПРАВИЛА ЭКСПЛУАТАЦИИ АККУМУЛЯТОРНЫХ СВИНЦОВО-КИСЛОТНЫХ СТАРТЕРНЫХ БАТАРЕЙ

типы батарей

TYPES OF BATTERIES

3СТ-60, 3СТ-70, 3СТ-84, 3СТ-98, 3СТ-112, 3СТ-126, 3СТ-135, 6СТ-42, 6СТ-54, 6СТ-68, 6СТМ-128, 6СТЭН-140, 6СТК-135, 6СТК-180

OPERATING INSTRUCTIONS FOR LEAD STARTER STORAGE BATTERIES

I. ЭЛЕКТРИЧЕСКИЕ ХАРАКТЕРИСТИКИ АККУМУЛЯТОРНЫХ БАТАРЕЙ

1. Электрические характеристики аккумуляторных батарей должны соответствовать данным, указанным в табл. 1.

Таблица 1

Типы батарей	Номинальное напряжение, V	Разрядный ток при 10-часовом режиме разряда, А	Емкость при 10-часовом режиме разряда и средней температуре электролита +30°С, Ah	Разрядный ток на стартерном режиме, А
3СТ-69	6	6,0	60	180
3СТ-70	6	7,0	70	210
3СТ-84	6	8,4	84	250
3СТ-98	6	9,8	98	295
3СТ-112	6	11,2	112	335
3СТ-126	6	12,6	126	380
3СТ-135	6	13,5	135	405
6СТ-42	12	4,2	42	125
6СТ-54	12	5,4	54	160
6СТ-68	12	6,8	68	205
6СТМ-128	12	11,2	112	360
6СТЭН-140	12	12,6	126	420
6СТК-135	12	12,2	122	340
6СТК-180	12	15,4	154	500

II. ПРИВЕДЕНИЕ БАТАРЕЙ В РАБОЧЕЕ СОСТОЯНИЕ

А. ЗАЛИВКА БАТАРЕЙ ЭЛЕКТРОЛИТОМ

2. В зависимости от климатического пояса, в котором работают аккумуляторные батареи, их заливают различными по плотности растворами серной кислоты, указанными в табл. 2.

Таблица 2

Климатический район	Плотность электролита при 20°С
[illegible] районы с температурой выше —35°С	Зимой 1,31 Летом 1,27
[illegible] районы с температурой выше —50°С	1,27
[illegible] районы (в том числе тропические)	1,25

3. Электролит для заливки аккумуляторов готовят из серной кислоты и дистиллированной воды. Температура электролита, заливаемого в батареи, должна быть по возможности 18—25°С и в крайнем случае не превышать 45°С.

4. Кислота должна быть высокого качества. При удельном весе кислоты в пределах 1,82—1,83 (при 20°С) содержание примесей в ней не должно превышать количеств, указанных в табл. 3.

5. Для приготовления электролита применяется стойкая к действию серной кислоты посуда (керамиковая, эбонитовая, свинцовая), в которую заливается сначала вода, а затем — при непрерывном перемешивании воздухом или веслом из кислотостойкого материала — серная кислота.

Вливать воду в концентрированную серную кислоту категорически воспрещается во избежание несчастных случаев от ожогов.

6. Рабочие, занятые приготовлением растворов серной кислоты, во избежание ожогов

[illegible] работать в резиновых галошах, ре[illegible] перчатках и резиновых фартуках. [illegible] быть прикрыты защитными

[illegible] попадании брызг на лицо [illegible] нужно осторожно снять [illegible] быстро смочить это место вод[illegible] соды или аммиака.

Таблица 3

Наименование примесей	Содержание примесей, %
Марганец	не более 0.0001
Железо	» 0.012
Мышьяк	» 0.0001
Хлор	» 0.0005
Окислы азота (N_2O_3)	не более 0.0001
Вещества, восстанавливающие марганцево-кислый калий	не более чем 400 мл 0.01 N раствора $KMnO_4$ на 1 литр кислоты
Тяжелые металлы, осаждаемые сероводородом (кроме Pb и Fe)	не должно происходить изменения цвета, выпадания осадка

Б. ПЕРВЫЙ ЗАРЯД

7. Батареи, устанавливаемые на первый заряд, должны быть тщательно вытерты от пыли, а также от вазелиновой или тавотовой смазки (если ею покрыты межэлементные соединения и выводные зажимы). До заливки электролита в батареи 3СТ-70, 3СТ-84, 3СТ-98, 3СТ-112, 3СТ-126, 6СТ-42, 6СТМ-128, 6СТЭН-140, 6СТК-135 и 6СТК-180 из них удаляют герметизирующие диски из-под пробок (эти детали обратно в батареи не ставятся). Затем в батареи заливают электролит до уровня на 10—15 *мм* выше предохранительного щитка, расположенного над сепараторами.

В аккумуляторных батареях типов 3СТ-60, 3СТ-135, 6СТ-54 и 6СТ-68 могут быть камерные крышки с вентиляционными отверстиями. Перед приведением таких батарей в рабочее состояние удаляют трубочки, вставленные в вентиляционные отверстия, вывертывают пробки, плотно надевают их на вентиляционные штуцеры и заливают электролит до уровня, который на 15—20 *мм* ниже верхнего края горловины.

После этого снимают пробки с вентиляционных штуцеров, и электролит в аккумуляторах опускается до нормального уровня.

8. По истечении 3—4 часов после заливки электролита, при температуре его не выше 50° С, батареи ставят на заряд. При температуре электролита выше 50° С ему следует дать остыть до этой температуры и только после этого батарею включить на заряд.

При возможности лучше начать заряд при температуре электролита не выше 25° С. Положительную клемму батареи присоединяют к положительному полюсу источника тока, а отрицательную — к отрицательному.

Таблица 4

Типы батарей	Зарядный ток, А		Объем электролита, необходимый для наполнения батарей, *л*
	Заряды		
	первый	последующие	
3СТ-60	3,5	5,0	2,3
3СТ-70	5,0	6,5	2,5
3СТ-84	6,0	8,0	2,7
3СТ-98	6,5	9,0	3,5
3СТ-112	7,0	10,0	4,0
3СТ-126	7,5	10,0	4,5
3СТ-135	7,5	10,0	4,8
6СТ-42	3,0	4,0	3,0
6СТ-54	3,5	5,0	3,8
6СТ-68	4,5	6,0	5,0
6СТМ-128	6,0	10,0	7,2
6СТЭН-140	8	10,0	7,5
6СТК-135	8	10,0	10,0
6СТК-180	10	12,0	10,0

Примечание. В особых случаях, при необходимости срочного ввода в эксплуатацию, допускается установка батарей на объект без заряда при условии, что плотность электролита по истечении трех часов после заливки понизилась в сравнении с плотностью заливаемого электролита (при одной и той же температуре) не более, чем на 0,03 единицы удельного веса.

9. Сила тока при первом и последующих зарядах, а также объем электролита, необходимый для наполнения батареи, указаны в табл. 4.

10. Заряд продолжают до тех пор, пока не наступит обильное газовыделение во всех аккумуляторах батарей, а напряжение и плотность электролита не останутся постоянными в течение двух часов. Напряжение контролируется вольтметром со шкалой на 3 V, с ценой деления в 0,02 V и не ниже класса точности 1,0. В любом случае длительность заряда должна быть не менее 5 часов.

11. Во время заряда периодически проверяют температуру электролита и следят за тем, чтобы она не поднималась выше 60° С. В противном случае снижают зарядный ток наполовину или прерывают заряд на время, необходимое для падения температуры электролита до 50° С.

12. К концу первого заряда плотность электролита должна быть такой же, какой была залита батарея (при одной и той же температуре, см. табл. 5).

Таблица 5

Плотность заливаемого электролита при температуре 20° С	Изменение плотности электролита в зависимости от изменения его температуры			
	+30°С	+40°С	+50°С	+60°С
1,31	1,305	1,295	1,290	1,280
1,27	1,265	1,255	1,250	1,240
1,25	1,240	1,235	1,230	1,220

Если плотность электролита будет выше, то электролит корректируют дистиллированной водой и продолжают заряд еще 30 мин. Затем батарею выключают, дают постоять не менее 30 мин и производят замер уровня электролита во всех аккумуляторах батареи.

Уровень электролита должен быть строго в пределах, указанных в п. 7 настоящих правил ухода. При уровне электролита в отдельных аккумуляторах или во всех аккумуляторах батареи ниже нормы добавляют электролит той же плотности, какой заливалась аккумуляторная батарея.

При уровне электролита выше нормы отбирают часть электролита резиновой грушей до требуемого уровня.

13. После первого заряда батареи закрывают пробками, обтирают чистой сухой ветошью и сдают в эксплуатацию.

III. УХОД ЗА АККУМУЛЯТОРНЫМИ БАТАРЕЯМИ И ЭКСПЛУАТАЦИЯ ИХ НА МАШИНАХ

14. При эксплуатации батарей на машинах необходимо систематически:

а) очищать батарею от пыли;

б) очищать выводные клеммы батареи и наконечники проводов от окислов, не допускать смазывания межэлементных соединений и выводных зажимов вазелином или тавотом (за исключением зажимов с резьбовой нарезкой);

в) вытирать чистой ветошью поверхность батареи от пролитого на нее электролита. Ветошь предварительно должна быть смочена в растворе нашатырного спирта или кальцинированной соды (10-процентный раствор);

г) проверять плотность крепления батареи в гнезде;

д) проверять крепление и плотность контакта наконечников проводов с выводными клеммами батарей. Для предупреждения порчи выводных клемм не допускать натяжения проводов;

е) проверять и при необходимости прочищать вентиляционные отверстия;

ж) проверять во всех элементах батареи уровень электролита, который должен быть строго в пределах, указанных в п. 7 настоящих правил ухода. При понижении уровня ниже

Доливку производить доливку аккумуляторов водой дистиллированной водой, пока электролит не примет нормальный уровень. В холодное время года, во избежание замерзания, воду следует добавлять непосредственно перед зарядом для быстрого перемешивания ее с электролитом во время заряда.

Примечание. С целью предохранения деревянных футляров батарей 6СТМ-128, 6СТЭН-140, 6СТК-135 и 6СТК-180 от разрушения рекомендуется их периодически подкрашивать или вытирать ветошью, увлажненной минеральным маслом.

15. Доливать электролит или кислоту в аккумуляторы воспрещается, за исключением тех случаев, когда точно известно, что понижение уровня электролита произошло за счет его выливания. При этом доливаемый электролит должен быть такой же плотности, какую имел электролит в аккумуляторе во время пролива-ния.

16. Следить за полнотой заряда аккумуляторов на машинах. При плотности электролита, соответствующей разряженности аккумуляторов (см. табл. 6) более чем на 25% зимой (при температурах ниже нуля) и более чем на 50% летом, батарею необходимо снять с машины и отправить на заряд.

Таблица 6

Плотность электролита при 20°С		
у полностью заряженной батареи	у батареи, разряженной на 50%	у батареи, разряженной на 25%
1,310	1,230	1,270
1,270	1,190	1,230
1,250	1,170	1,210

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I. ELECTRIC CHARACTERISTICS OF STORAGE BATTERIES

1. Electric characteristics of the storage batteries correspond to data given in table 1.

Table 1

Type of battery	Nominal voltage, V	10-hour discharge rate, A	Capacity for 10-hour discharge rate and average electrolyte temperature of +30°C, Ah	Discharge current for starting duty, A
3CT-60	6	6.0	60	180
3CT-70	6	7.0	70	210
3CT-84	6	8.4	84	250
3CT-98	6	9.8	98	295
3CT-112	6	11.2	112	335
3CT-126	6	12.6	126	380
3CT-135	6	13.5	135	405
6CT-42	12	4.2	42	125
6CT-54	12	5.4	54	160
6CT-68	12	6.8	68	205
6CTM-126	12	11.2	112	360
6CTSH-140	12	12.6	126	420
6CTK-135	12	12.2	122	340
6CTK-180	12	15.4	154	500

II. GETTING STORAGE BATTERIES READY FOR OPERATION

A. FILLING STORAGE BATTERIES WITH ELECTROLYTE

2. Depending upon the climatic zone in which the storage batteries operate, they are filled with sulphuric acid solutions of various density, as shown in table 2.

Table 2

Climatic region	Electrolyte density at 20° C
Extreme Northern regions with winter temperature below—35°C	in winter 1.31 in summer 1.27
Northern and Central regions with winter temperature to —25°C	1.27
Southern regions, the tropics included	1.25

3. The electrolyte for filling the storage batteries is prepared from sulphuric acid and distilled water. The temperature of electrolyte poured in the batteries should be +18 to +25° C and in any case it should not exceed +45° C.

4. The acid should be of a high quality.

With specific gravity of the acid within 1.82—1.83 (at 20° C) the acid should not contain impurities in excess of quantities given in table 3.

Table 3

Impurity	Impurity percentage
Manganese	not more than 0.0001
Iron	not more than 0.012
Arsenic	not more than 0.0001
Chlorine	not more than 0.0005
Nitrogen oxides (N_2O_3)	not more than 0.0001
Substances reducing potassium permanganate	not more than 400 ml 0.01 N solution of $KMnO_4$ per litre of acid
Heavy metals precipitable by hydrogen sulphide (except Pb and Fe)	no change of colour, no sedimentation should take place

5. To prepare the electrolyte, use sulphuric-acid resisting containers (ceramic, hard rubber, lead). First pour the water and then, while continuously stirring by means of air or a paddle made of sulphuric-acid resisting material-pour in the acid.

Under no circumstances should water be poured into strong sulphuric acid, to avoid being scalded.

6. When preparing sulphuric acid solutions, the personnel should operate in rubber galoshes, rubber gloves and rubber aprons. The eyes should be protected with goggles. If acid is accidentally spattered on to the face or hands of the operator, carefully remove it with cotton wool and quickly moisten this place with a water solution of soda or ammonia.

B. FIRST CHARGE

7. The batteries which are installed for the first charge, should be thoroughly wiped of dust. Vaseline or grease with which intercell connectors and terminals are coated should be removed as well.

Prior to filling with electrolyte the batteries, types 3CT-70, 3CT-84 3CT-98, 3CT-112, 3CT-126, 6CT-42, 6CTM-128, 6CTЭH-140, 6CTK-135 and 6CTK-180, remove the sealing discs from under the vent plugs (these disks are not to be reinstalled). Then pour the electrolyte into the battery to a level 10—15 mm above the lower cover placed over the separators.

Types 3CT-60, 3CT-135, 6CT-54 and 6CT-68 batteries can have chamber covers with ventilation holes. Prior to preparing such batteries for operation, remove the tubes inserted into the ventilation holes, turn off the vent plugs, put them on the ventilation unions and pour the electrolyte in up to a level 15—20 mm below the upper edge of the throat.

Then remove the vent plugs from the ventilation unions and the electrolyte in the battery will drop to the normal level.

8. In 3—4 hours after filling the battery with the electrolyte which should have a temperature not higher than 50° C, put the batteries on charge.

If the temperature of the electrolyte is higher than 50° C, it should be cooled down to this temperature and the battery then put on charge.

If possible, charge the battery with the electrolyte temperature not higher than 25° C. Connect the positive terminal of the battery to the positive lead of the supply source and the negative terminal—to the negative lead.

Note. In special cases the batteries can be installed for operation without preliminary charging provided that the electrolyte density, three hours after filling, drops by not more than 0.03 of density measurement unit as compared to the electrolyte density at the time of filling (at the same temperature).

9. The value of charging current during the first and the subsequent charges as well as the electrolyte volume required for the filling of the battery are given in table 4.

10. Continue to charge until all the batteries are abundantly gassing and the voltage as well

Table 4

Type of battery	Charging rate, A		Volume of electrolyte required to fill the battery, l
	Charges		
	first charge	subsequent charges	
3CT-60	3.5	5.0	2.3
3CT-70	5.0	6.5	2.5
3CT-84	6.0	8.0	2.7
3CT-98	6.5	9.0	3.5
3CT-112	7.0	10.0	4.0
3CT-126	7.5	10.0	4.5
3CT-135	7.5	10.0	4.8
6CT-42	3.0	4.0	3.0
6CT-54	3.5	5.0	3.8
6CT-68	4.5	6.0	5.0
6CTM-128	8.0	10.0	7.2
6CTЭH-140	8.0	10.0	7.6
6CTK-135	8.0	10.0	10.0
6CTK-180	10.0	12.0	10.0

as the electrolyte density remain constant for 2 hours.

The voltage is checked by a voltmeter having a 3 V scale with a 0.02 V scale division reading of accuracy class 1.0. In any case the duration of charge should not be less than 5 hours.

11. During the charge, periodically check the electrolyte temperature and see than it does not exceed +60° C. Otherwise, reduce the charging current by one half or stop to charge for a time to allow the temperature of the electrolyte to drop to +50° C.

12. At the end of the first charge the electrolyte density should be the same as it was while filling the battery at the same temperature (see table 5).

Table 5

Density of the electrolyte to be poured in at +20° C	Change of electrolyte density depending upon its temperature			
	+30°C	+40°C	+50°C	+60°C
1.31	1.305	1.295	1.290	1.280
1.27	1.265	1.255	1.250	1.240
1.25	1.240	1.235	1.230	1.220

If the electrolyte density is higher, add distilled water and continue to charge for 30 min more. Then switch off the supply current, let the battery rest for 30 min and measure the electrolyte level in all the cells.

The electrolyte level should be strictly within the limits given in p. 7 of present instructions. If the electrolyte level individual cells or in all the cells is below the normal level, add electrolyte having the same density as the electrolyte with which the battery had been filled. If the electrolyte level is higher than normal—pour off some of the electrolyte by a bulb to obtain the required level.

13. After the first charge, plug the batteries, wipe with clean, dry rags and put into operation.

III. MAINTENANCE OF STORAGE BATTERIES INSTALLED ON MACHINES

14. When operating the batteries on machines, do as follows:

a) clean the battery of dust;

b) clean the battery terminals and wipe lugs from oxide, do not coat the intercell connectors and terminals with vaseline or grease (with the expection of threaded terminals);

c) wipe the battery surface with clean rags to remove electrolyte; the rags should be previously moistened in a solution of ammonia spirit or soda ash (10% solution);

d) check the fastening of the battery in the recess;

e) check contact of the wire lugs with the battery terminals.

Do not tighten the wires to avoid damage of the terminals;

f) check and, if necessary, clean ventilation holes;

g) check the electrolyte level in all the cells which should be within the limits given in p. 7 of these instructions. If the electrolyte level is lower than prescribed in p. 7, add distilled water into the battery cells to obtain the normal level.

During the cold seasons, to avoid freezing, add the water just before charging to ensure quick mixing of the water with the electrolyte while charging.

Note. To protect the wooden cases of types 6СТМ-128, 6СТЭН-140, 6СТК-135 and 6СТК-180 batteries from damage it is recommended to coat them with paint periodically or wipe with rags slightly dipped in oil.

15. **Never add electrolyte or acid into the batteries** with the exception of cases when it is definitely known that the drop in level is due to loss of the electrolyte. The electrolyte to be added should be of the same density as the spilled electrolyte.

16. The batteries installed on machines should be always fully charged. If the density of the electrolyte indicates battery discharge (see table 6) greater than 25% in winter (at temperatures below zero) and greater than 50% in summer, remove the battery from the machine and send it to be charged.

Table 6

Density of electrolyte at 20° C		
fully charged battery	discharge to 50%	discharge to 25%
1.310	1.230	1.270
1.270	1.190	1.230
1.260	1.170	1.210

Printed in the Soviet Union

ATTENTION!

It must be taken into account that engine cooling system differs from that described in the Book in following:

1. The radiator cap has an outlet valve opening under the over-pressure of 0.45—0.50 kg/sq. cm.

2. Green tell-tale light is flashing on when the temperature of cooling water increases up to 105 — 110 C.

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CROSS-COUNTRY CAR

ГАЗ-69

OPERATION MANUAL

VSESOJUZNOJE OBJEDINENIJE
AVTOEXPORT
Moscow

25X1

CAUTION

While operating the ГАЗ-69 Automobile observe the following rules:

1. Follow the maintenance recommendations outlined in this Manual.

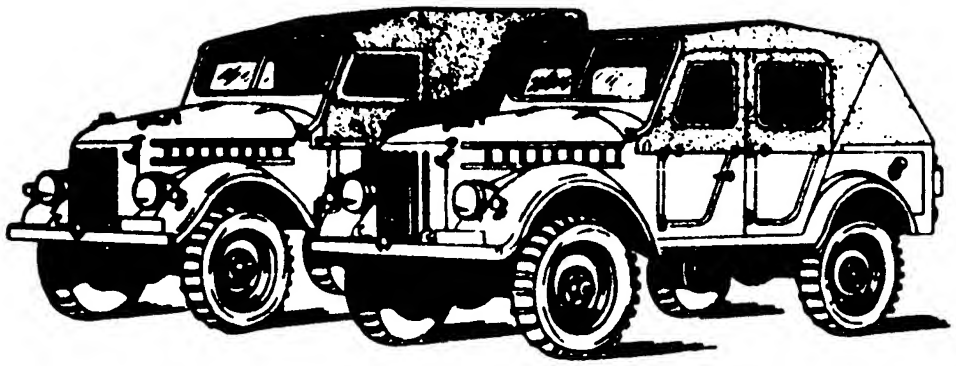


Fig. 1.

2. Use gasoline of not less than 66 octane number and oils of such grades as recommended in the Lubrication Instructions.

3. Regularly change the fine oil filter element.

4. Change engine crankcase oil at regular intervals. Do not work the engine with insufficient oil in the crankcase.

5. Drain the cooling system through two cocks, simultaneously opening the radiator cap and heater cock.

6. Maintain the temperature of cooling water within the range of 80° to 90° C. In winter use a warm cover on the engine hood. Do not work the engine with insufficient water in the radiator.

7. Check frequently the opening of the carburettor main jet needle. The needle should be turned off 1 1/2 or 2 turns.

8. The limiter throttle washer installed at the Manufacturer's Works between the carburettor and inlet manifold should be removed only after completion of running-in. In the lower rear part of the inlet pipe there is a plug for draining excess gasoline accumulating due to overchoking.

9. Enrichment of mixture by means of the choke button should be used with discretion, when starting a cold engine only.

10. Never race the engine and do not start the automobile with the engine insufficiently warmed up.

11. Fill the hydraulic brake system with a special brake fluid only. Never use the hand brake while the automobile is in motion. The hand brake is intended for parking only.

12. Engage the front driving axle for driving over difficult roads only.

13. Adjust in due time all assemblies and mechanisms of the automobile. Do not use the automobile with an excessive play in the clutch pedal and brake pedal and backlash in the steering gear.

14. Before putting a new automobile into service it should be run-in in conformity with instructions contained in this Manual.

SPECIFICATIONS

GENERAL DATA

Model	ГАЗ-69, ГАЗ-69А
Type	cross-country automobile with two driving axles
Load-carrying capacity:	
ГАЗ-69	8 passengers or 2 passengers and 500 *kg* of load
ГАЗ-69А	5 passengers and 50 *kg* of load
Maximum weight of loaded trailer, *kg*	800
Overall dimensions, *mm*:	
length	3,850
width	
ГАЗ-69	1,850
ГАЗ-69А	1,750
height	
ГАЗ-69	2,030
ГАЗ-69А	1,920
[illegible], *mm*	2,300
[illegible] (front and rear wheels), *mm*	1,440
[illegible] clearance, *mm*	210
[illegible], *m*	6
[illegible] of automobile, *kg*:	
[illegible]	1,525
[illegible]	1,535
[illegible] speed, *km/hr*	90
[illegible] on solid soil:	
[illegible]	30°
[illegible] trailer	20°
[illegible]	66 octane number

ENGINE

[illegible]	four-stroke cyle gasoline engine
[illegible]	4
[illegible]	[illegible]
[illegible]	2[illegible]

Displacement, *litres*	2.12
Compression ratio	6.5
Horsepower at 3600 r.p.m.	55
Maximum torque, *kg m*	12.7
Firing order	1-2-4-3
Engine mounting	floating, on three points
Cylinder head	of aluminium alloy
Cylinders	of cast iron with short liners of anti-corrosion cast iron
Pistons	of aluminium with two compression rings and two oil control rings
Crankshaft	of steel with counter-weights, on four bearings
Connecting rods	symmetrical
Bearing shells	thin-walled, bimetallic type
Camshaft	of steel. Forced lubrication of journals. Driven by a pair of gears
Valves	Valve head diameter, *mm:* Inlet — 39 Exhaust — 36
Valve lifters	disc type with adjusting bolts
Valve data (0.35 *mm* clearance)	Inlet Valve: opens — 9° before TDC closes — 51° past BDC Exhaust Valve: opens — 47° before BDC closes — 13° past TDC
Inlet manifold	on R. H. side of engine. In the center there is a mixture heating chamber with automatically controlled throttle valves
Lubricating system	combination forced and splash type
Oil suction bell	floating type
Oil filters	two: coarse oil filter of plate type and fine oil filter with replaceable filter element
Oil cooler	tubular type. Operated by a cock located near oil pump
Crankcase ventilation	forced type
Lubricating system valves	relief valve locatad in oil pump cover. Bypass valve in coarse oil filter body
Gasoline sediment bowl	mounted on L.H. side of frame. Diaphragm type with inverted sediment
Fuel pump	bowl. Equipped with a manual fuel lift device
Carburetor	K-22 type with adjusting needle
Air cleaner	screen type with oil cup
Cooling	forced water circulation
Radiator	gilled-tubes in three rows
Radiator filler cap	air-tight, equipped with two valves
Radiator blind	installed in front of radiator. Controlled frof driver's seat
Thermostat	opens at 70° – 82° C
Water pump	centrifugal type with self adjusting seal
Fan	six-blade type, belt-driven from crankshaft
Starting heater	mounted on engine L.H. side under the hood. Consists of boiler and heater torch

POWER TRANSMISSION

Clutch	dry, single-plate type
Transmission	two-range gear box with three speeds forward and one reverse
Overall ratios:	
1 st gear	3.115
2 nd gear	1.772
3 rd gear	1.00
Reverse	3.738
Transfer Case	two-speed with gear ratios 1.15 and 2.78. Two levers for shifting into high and low speeds and also for engaging and disengaging the front axle. Low speed gear ratio 2.78 can be engaged with engaged front axle only
Propeller shafts	three shafts: intermediate, rear and front; universal joints on needle bearings
Bevel gear in front and rear axles	spiral bevel gear. Ratio 5.125
Differential	bevel gear with two satellites
Axle shafts	full floating type
Transmission of pushing and torque reaction	by springs

RUNNING GEAR

Number of wheels	two front wheels, two rear wheels, one spare wheel
Tyres	low pressure, 6.50 × 16″. Tread with non-skid pattern
Front wheel angles	camber 1°30′; king pin inclination 5°; caster 3°; toe-in 1.5 to 3 *mm*
Suspension	four longitudinal semi-elliptical springs, four hydraulic piston type two-way shock absorbers

STEERING GEAR

Type	globoid worm with twin roller
Steering wheel	three-arm type
Steering rods	tubular type with ball pins
Foot brakes	four-wheel, shoe type; hydraulic drive from foot pedal
Hand brake	shoe type, mechanically operated. Located on transfer case

ELECTRIC EQUIPMENT

Voltage	12
Generator	G20 type, 12 V, 18 A, shunt-wound machine with current and voltage regulator and circuit breaker of PP20 type
Storage battery	6CT-54 type, 12V, 54 A-h
Starter unit	BI type, with additional resistor cut-in during engine starting
Ignition coil	P20 type with centrifugal and vacuumatic spark advance control and octane selector
Sparking plugs	M12Y type; 18 × 1.5 *mm* thread
Starter drive	Gear type with forced engagement

Lighting equipment	two head lamps with traffic and country light. Two side lamps, one spotlight, tail light with »Stop» and license lamps, inspection lamp, hood lamp, instrument panel light, two instrument lights
Light switches	two: master switch and foot switch
Sockets	two: for inspection lamp and trailer lamp
Horn	C56-B type, electric, vibration type
Fuse	heat fuse, button type in lighting circuit, ordinary fuses in horn, tail light and instrument light circuits
Electric wiring	single wire type (positive pole grounded to the frame)
Instruments and tell-tale lamps	instrument cluster (speedometer with odometer, gasoline level gauge, oil pressure gauge, ammeter and water thermometer). Green tell-tale lamp showing excessively high temperature in radiator; country light red indicator lamp.

BODY AND BODY EQUIPMENT

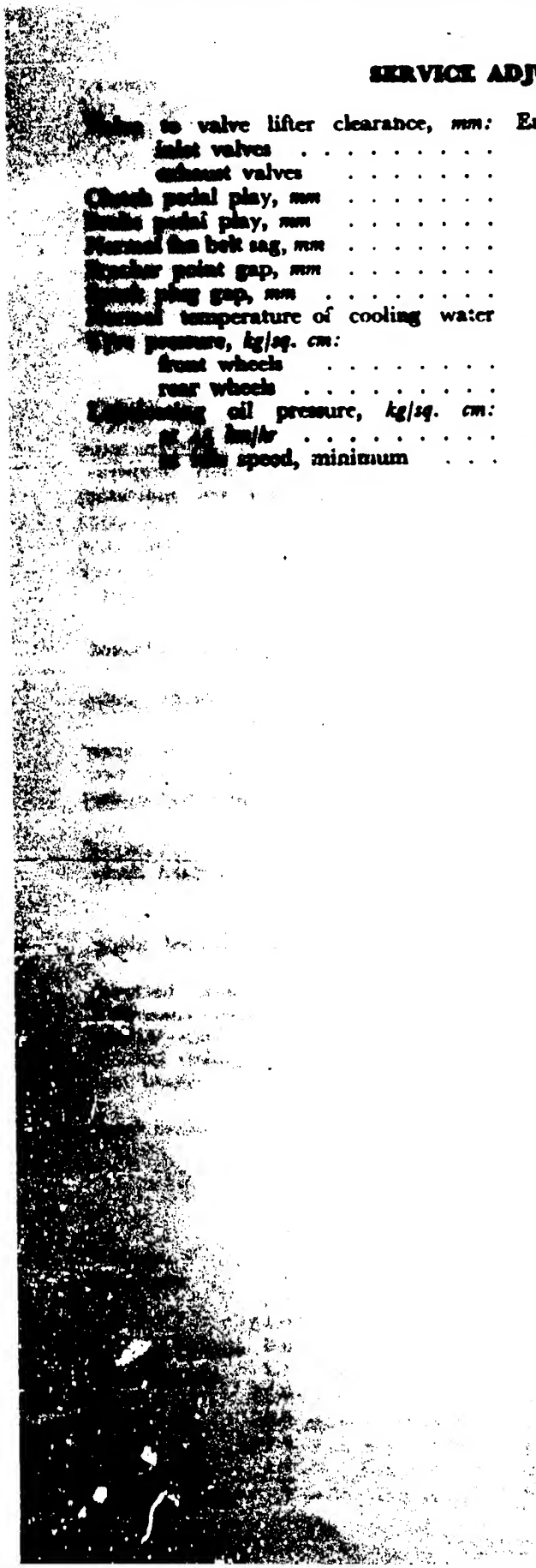
Body:	
ГАЗ-69	all-metal, two-door type with folding tailboard and removable canopy
ГАЗ-69А	all-metal, four-door type with luggage compartment and removable canopy
Body equipment	canopy, electric screen wiper with two wiper blades, rear view mirror, two sun visors, two mats, hand strap, body heater and screen defroster
Windscreen	adjustable in special frame
Front seats	two cushioned, removable, with cushioned backrests
Rear seats:	
ГАЗ-69	two folding semi-cushioned seats located along body side boards
ГАЗ-69А	one cushioned seat with cushioned backrest
Body heating and ventilation	ventilation port in front of windscreen controlled from driver's seat. Air is heated by water heater
Windscreen defrosting	by warm air from electric ventilator

CAPACITIES, LITRES

ГАЗ-69 Fuel tanks:	
main	48
auxiliary	27
ГАЗ-69А Fuel tank	60
Cooling system	12
Lubricating system (incl. filters)	5.5
Air cleaner	0.25
Transmission housing	0.8
Transfer case housing	1.1
Front and rear axle casings (each	0.75
Steering gear case	0.33
Shock absorbers (each)	0.145
Hydraulic brakes	0.4
Spare oil can	6

SERVICE ADJUSTMENT DATA

	Engine warm	Engine cold
Valve to valve lifter clearance, *mm:*		
inlet valves	0.20	0.23
exhaust valves	0.25	0.28
Clutch pedal play, *mm*	38 to 45	
Brake pedal play, *mm*	8 to 14	
Flywheel fan belt sag, *mm*	10 to 15	
Breaker point gap, *mm*	0.35 to 0.45	
Spark plug gap, *mm*	0.7 to 0.8	
Normal temperature of cooling water	80 to 90° C	
Tire pressure, *kg/sq. cm:*		
front wheels	2	
rear wheels	2.2	
Lubricating oil pressure, *kg/sq. cm:*		
at 40 km/hr	2 to to 4	
at idle speed, minimum . . .	0.5	



CONTROLS AND INSTRUMENTS

Arrangement of controls and instruments is shown in Figs. 2 and 3.

Two windscreen wipers and wiper switch are installed in the upper part of the windscreen.

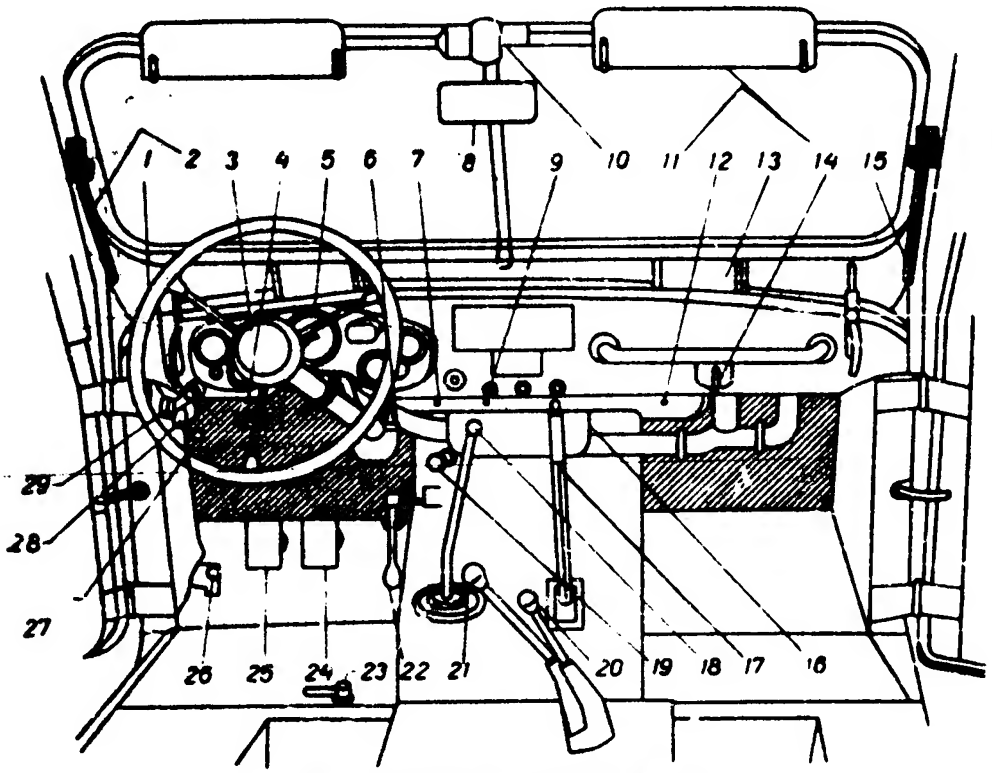


Fig. 2. Instruments and Controls

1 — steering wheel, *2* — windscreen frame latch, *3* — horn button, *4* — radiator blind handle, *5* — instrument cluster, *6* — ventilation port lever; *7* — lighting fuse button, *8* — mirror, *9* — instrument illumination switch, *10* — windscreen wiper switch, *11* — windscreen wiper, *12* — body lighting lamp switch, *13* — windscreen defroster, *14* — body lighting lamp, *15* — windscreen adjusting arm, *16* — heater, *17* — brake lever, *18* — gear shift lever, *19* — starter pedal, *20* — transfer case lever, *21* — front axle control lever, *22* — accelerator pedal, *23* — three-way cock (ГАЗ-69), *24* — brake pedal, *25* — clutch pedal, *26* — lighting foot switch, *27* — spotlight lamp switch, *28* — fuse block, *29* — socket.

Located on the instrument panel are: instrument cluster consisting of the speedometer, ammeter, gasoline level gauge (main tank), thermometer for cylinder head cooling water, engine oil pressure gauge:

instrument illumination lamps, country beam indicator red lamp and green tell-tale lamp showing engine overheating.

The lighting master switch button has three positions: pressed all the way in — lighting is switched off; pulled halfway out — side lamps and tail light are on; pulled all the way out — head lamps and tail

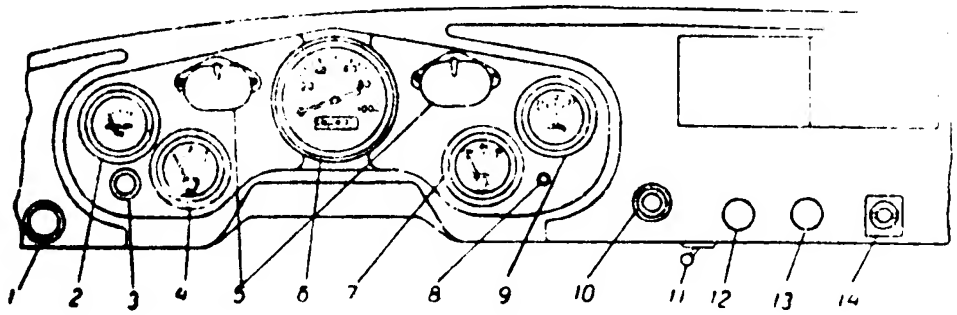


Fig. 3. Instrument Panel

1 — lighting master switch, *2* — gasoline level gauge, *3* — water temperature tell-tale lamp, *4* — oil pressure gauge, *5* — instrument light, *6* — speedometer, *7* — thermometer, *8* — country light indicator lamp, *9* — ammeter, *10* — ignition switch, *11* — instrument light switch, *12* — choke button, *13* — manual throttle control button, *14* — defroster switch.

light are on. Ignition switch is turned on by moving it clockwise. Choke knob pulling the knob out closes the choke. Manual throttle control to open throttle valve pull the button out. Defroster switch has three positions: middle — ventilator is switched off, — left low speed of ventilator, right — high speed of ventilator. Cab lighting lamp.

Located on the lower edge of the instrument panel are: lighting fuse button; instrument panel lighting switch (operates with the master lighting switch turned ON only); cab lighting lamp switch.

Under the instrument panel there are: radiator blind control handle (to close — move back, to open — move forward); ventilation port door lever (to open — move back); inspection lamp socket; fuse block; spotlight switch.

Located on the floor are: lighting foot switch; clutch pedal; brake pedal; accelerator pedal; starter pedal; gear shift lever; front axle engagement lever; transfer case control lever; hand brake lever; three-way gasoline cock (ГАЗ-69); steering column; horn button is mounted on steering column.

RUNNING-IN A NEW AUTOMOBILE

Service life of the automobile depends to a considerable extent on the care it receives at initial stages of operation, i. e. during running-in. When running in the automobile during the first 1000 km the following rules should be adhered to:

1. Do not drive the automobile at a speed of over 45 or 50 km/hr [illegible] gear, 25 km/hr in 2nd gear and 15 km/hr in first gear.

2. Do not start the automobile with the engine insufficiently warmed up. Do not race the engine.

3. Do not overload the automobile. Avoid driving over poor roads.

4. When running in the automobile use a less viscous (winter) grade of oil.

5. Check frequently the temperature of brake drums and adjust the brakes if necessary.

6. Check frequently the temperature of wheel hubs and loosen the adjusting nut if the hubs are exceedingly heated.

7. Inspect all the attachments, tighten loose bolts and nuts.

8. Check carefully all piping for leaks and eliminate oil, water and brake fluid leaks.

BEFORE THE FIRST RUN

1. Check the water level in the radiator, oil level in the engine crankcase, electrolyte level in the storage battery, brake fluid level in the brake master cylinder, oil level in the air cleaner oil cup, tyre pressure, tightening of wheel nuts.

2. Check the oil level in the transmission housing, transfer case housing, front and rear axle casings.

3. Lubricate all the points of the automobile that should be lubricated every 500 and 1000 km (see Lubrication Chart).

4. Start the engine and check all connections for oil, water and fuel leaks.

AFTER 500 KM RUN

1. Replace crankcase oil.

2. Lubricate all the points of the automobile that should be lubricated every 500 and 1000 km (see Lubrication Chart).

3. Tighten wheel nuts, steering arm nuts, universal joint nuts.

AFTER 1000 KM RUN (AT THE END OF RUNNING-IN)

1. Remove the seal and take out the limiter washer located between the carburettor and inlet manifold flanges.

2. Tighten the cylinder head stud nuts in the sequence shown in Fig. 4. The nuts should be tightened on a cold engine.

3. Tighten the exhaust manifold to engine and exhaust manifold to muffler attachments.

4. Tighten the generator bracket.

5. Check fan belt tension and adjust if necessary.

6. Check throttle valve and choke actuating parts and adjust if necessary.

7. Inspect and clean fuel pump sediment bowl.

8. Adjust engine idle speed.

9. Check the electrolyte level in the storage battery, add distilled water if necessary.

10. Tighten the terminals and coat them with vaseline.
11. Check condition and connections of electrical wiring.
12. Blow through the generator and starting motor with compressed air and inspect the commutator.

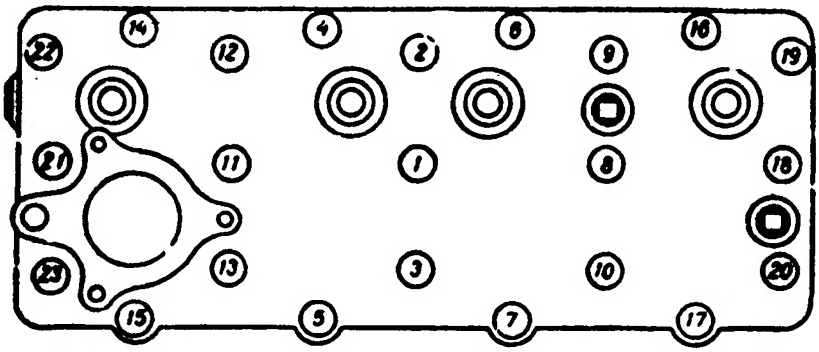


Fig. 4. Cylinder Head Stud Tightening Sequence

13. Adjust the play of the clutch and brake pedals.
14. Check adjustment of foot and hand brakes.
15. Check the fluid level in the brake master cylinder.
16. Tighten rear axle shaft attachment nuts and front axle driving flanges.
17. Tighten the attachments of the following parts; king pin plates, steering levers, transfer case brackets, front axle ball supports, sprong clips, spring bolts, shock absorbers and all the other loose attachments.
18. Drain sediment from engine oil filters. Check operation of the coarse oil filter self-cleaner.
19. Change oil in engine crankcase, air cleaner, front and rear axle housings, transmission and transfer case housings.
20. Lubricate all the points that are to be lubricated after 500 and [illegible] km (see Lubrication Chart).
21. During the following 3000 km do not drive the automabile continuously at a speed of over 70 km/hr and do not race the engine.

STARTING AND STOPPING THE ENGINE

[illegible]ending on temperature conditions the engine should be started as follows.

STARTING A WARM ENGINE

2. [illegible] the ignition switch on.
3. Depress the starter pedal and keep it depressed until the engine [illegible] not over 5 sec.
4. [illegible] and fully serviceable engine fails to start this may be [illegible] exceedingly rich mixture due to choking or pumping of [illegible] by the accelerator pedal.

To eliminate over-enrichment blow through the cylinders by smoothly depressing the accelerator pedal and crank the engine by the starting motor.

When starting a very hot engine it is recommended simultaneously with depressing the starter pedal to depress the accelerator pedal for scavenging the cylinders.

STARTING A COLD ENGINE AT A TEMPERATURE OVER −5° C

1. Prime the carburettor using the fuel pump hand lever.
2. Pull out the carburettor choke button as far as it will go.
3. Release the clutch, depressing the pedal all the way down.
4. Turn the ignition switch on.
5. Depress the starter pedal and keep it depressed not over 5 sec. The intervals between each application of the starter should not be less than 10 or 15 sec.
6. As soon as the engine starts to fire under its own power, depress the choke button 1/4 of its travel and increase engine speed by the accelerator button or pedal.

An engine in good repair is usually started afted first or second attempt. As the engine is warmed up, press the choke button in gradually.

If the engine fails to start after three attempts it is necessary to scavenge the cylinders.

As a rule difficult starting of the engine with correct use of the choke is caused by the following:

1. No fuel supply to the carburettor.
2. Breaker point gap out of adjustment or breaker points burned
3. Faulty or soiled spark plugs.
4. Faulty wiring.

Start the automobile only after warming up the engine. To speed up warming close the radiator blind and hood cover flaps.

STARTING A COLD ENGINE AT LOW TEMPERATURES

To ensure prompt and reliable starting of the engine at low temperatures warm up the engine by the use of the starting heater or by filling the engine with hot water and oil.

To start the engine in cold weather the ГАЗ-69 automobile is provided with a starting heater mounted under the hood on the L. H. side of the engine.

Prepare the automobile for starting in the following order:

1. Close the drain cock on the heater boiler and unscrew the boiler filler plug.
2. Light the starting heater torch (Fig. 5.) For this purpose screw in the torch tank plug, turn in the adjusting needle, make a few strokes with the pump, pour some gasoline into the burner cup and light up the gasoline. After 10 min open partly the adjusting needle and close the burner cap.

3. To facilitate placing of the torch into the heater boiler turn the front wheels of the automobile to the extreme right position.

4. Remove the access hole cover on the left fender mudguard, reduce the torch flame and place the torch into the fire tube of the heater boiler.

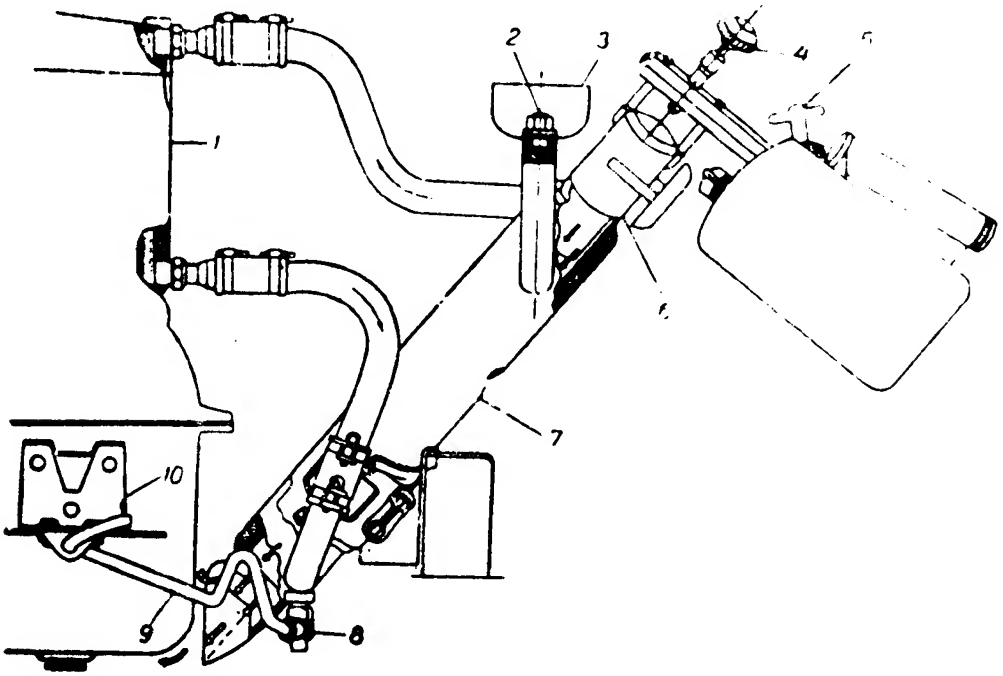


Fig. 5. Starting Heater

1 — Cylinder block, *2* — boiler plug, *3* — funnel, *4* — heater torch adjusting needle, *5* — torch pump handle, *6* — torch burner, *7* — heater boiler, *8* — drain cock, *9* — drain cock handle, *10* — drain cock spring.

5. Pour 4 liters of water into the heater boiler to the filter hole evel, screw in the plug and increase the torch flame.

6. After 20 or 30 min, when the cylinder head is heated to 45 or 50° C, turn the crankshaft by the starting handle.

7. Remove the starting heater torch from the heater boiler and open partly the hood to ventilate the space under it.

8. Start the engine as described above.

9. As soon as the engine fires close the drain cock and fill the cooling system with water.

10. Put out the heater torch by unscrewing partly the torch tank filler plug.

STOPPING THE ENGINE

After working the automobile under a heavy load allow the engine run at low idle speed for 2 min before stopping it.

The engine is stopped by turning the ignition switch off.

When the automobile is to be parked for a long time at a low temperature, drain water from the cooling system. The water is

drained though two cocks: one located on the radiator and the other — on the starting heater boiler. When draining the cooling system remove the radiator filler cap and open the heater cock on the cylinder head.

MAINTENANCE SCHEDULE

The life of the automobile will be extended in proportion to the attention paid to the regular maintenance and correct operation of the automobile. The Manufacturer recommends the following maintenance schedule.

DAILY MAINTENANCE

1. Check the fuel, water and oil levels and top up to the correct level.
2. Check the fuel, water, oil and brake fluid leaks.
3. Check the presence, good working order and reliability of fastening tools and equipment.
4. Inspect and clean the storage battery, coat the terminals with vaseline and check attachment of cables. Clear ventilation holes.
5. Check fan belt tension.
6. Start the engine, listen to its operation noises, check functioning of the instruments.
7. Check condition of springs and shock absorbers.
8. Check tightening of the wheels. Inspect the tyres and check tyre pressure.
9. Check connection of steering rods.
10. Check service ability of the steering gear, brakes, horns and electric lighting.

1,000 KM MAINTENANCE

1. Check fan belt tension.
2. Check functioning of the radiator cap valves.
3. Drain sediment from the sediment bowl.
4. Check connections of the electric wiring.
5. Check electrolyte level in the storage battery and add distilled water if necessary.
6. Check and adjust the play of the clutch and brake pedals.
7. Check and adjust the foot brake.
8. Check the level of the brake fluid in the brake master cylinder.
9. Check attachments of the steering gear vase, steering levers, steering arm, generator bracket.
10. Lubricate the automobile in accordance with Lubrication Chart.

3,000 KM MAINTENANCE

1. Perform operations listed in 1,000 km maintenance.
2. Inspect the tyres. Interchange the wheels together with tyres. Adjust wheel toe-in.

6,000 KM MAINTENANCE

1. Perform all operations listed in 3,000 km maintenance.
2. Tighten the exhaust manifold and muffler attachments.
3. Inspect fuel pump attachments, condition of the flexible hose and check all connections for tightness.
4. Drain sediment from the fuel tanks.
5. Clean the breaker points and adjust gap. Check ignition timing.
6. Inspect the spark plugs and adjust spark plug gap.
7. Tighten the generator bracket fastenings.
8. Check functioning of the radiator cap valves.
9. Check operation of the governor.
10. Inspect condition of electric wiring.
11. Inspect condition of generator and starter brushes and commutator. Blow out the generator and starter and clean their commutators.
12. Check horn attachment.
13. Check head lamp adjustment.
14. Remove the wheel hubs, clean the brakes and change lubricant in wheel hubs. Check and adjust backlash in the steering knuckle and king pins.
15. Tighten brake plate attachments. Adjust wheel bearings.
16. Inspect condition of steering rod heads.
17. Inspect condition of the shock absorbers, add fluid, if necessary.
18. Remove and blow out the front axle and rear axle breathers, also the transfer case and transmission breathers.
19. Inspect condition of the propeller shafts, their joints and connections.
20. Check and adjust the hand brake.
21. Check and adjust toe-in of the front wheels.
22. Check condition of the spring rubber bushes.
23. Remove the propeller shafts and tighten flange attachments, check and adjust the axial play in the bearings of the front axle and rear axle drive gears and in the bearings of the transfer case lower shaft.
24. Check fastening of the body parts.
25. Lubricate the automobile in accordance with Lubrication Chart.

12,000 KM MAINTENANCE

1. Perform all operations listed in 6,000 km maintenance.
2. Disassemble and clean the carburettor. Check the fuel level in the float chamber. Adjust closing of the choke valve, and idle speed and the main jet needle as well.
3. Check crankcase vent pipes and inlet manifold and remove dirt deposits.
4. Remove and clean the coarse oil filter.
5. Check functioning of the centrifugal and vacuumatic spark advance mechanisms.

6. Remove the starting motor, disassemble, clean and lubricate.

7. Remove and clean the fuel sediment bowl.

8. Inspect wheel hub bearing, change lubricant and clean the brake system as follows:

a) Remove wheel hubs.

b) Flush out the hubs, steering knuckles and bearings and check their condition.

c) Clean and wipe the brake drums and plates.

d) Disassemble and clean the wheel brake cylinders. Flush the piping with alcohol or brake fluid. Lubricate the pistons with castor oil or brake fluid.

e) Check wear of brake linings.

f) Remove the front wheel brakes steering knuckles; remove the joints and change lubricant.

g) Tighten the attachments of the steering rods and levers and the attachment of the rear brakes to the axle shaft housing flanges.

h) Pack the hubs with fresh grease and put them in place.

i) Adjust wheel bearings.

j) Fill the brake system with fluid and bleed the system.

9. Lubricate the automobile in accordance with Lubrication Chart.

SEASONAL MAINTENANCE

1. In accordance with Lubrication Chart change oil in the engine crankcase, transmission, transfer case, steering gear and front and rear axles.

2. In autumn clean and flush out the body heating system.

3. Change specific gravity of electrolyte according to the season.

YEARLY MAINTENANCE

1. Remove the shock absorbers, take out the valves, flush out the valves and body.

2. Remove the springs, disassemble them and lubricate. Inspect rubber bushes.

3. Remove the upper cover of the transfer case, check axial play of the countershaft. If a considerable play is discovered, remove the rear cover and adjust the play using adjusting shims. Check the axial play in the bearings of the lower shaft and adjust the play using adjusting shims.

4. Remove the main brake, disassemble, clean, lubricate and adjust the shoe to drum clearance.

LUBRICATION

The Lubrication Chart is shown in Fig. 6. The Chart comprises all the points to be lubricated, lubrication intervals and grades of lubricant used. Symmetrical lubrication points located on the opposite side of the automobile are shown in dotted lines. Figures indicate lubrication intervals expressed in kilometers of operation. When operating the automobile over dusty roads lubricate all 1,000 km points every 500 km. Lubricant grades are shown on the Chart by letters, the meaning of which is explained in the Table below.

LUBRICANT TABLE

Symbol	Summer Grade (over + 5°C.)	Winter Grade (below + 5°C.)
M	Industrial oil Grade 50 Engler viscosity 5.76—7.86° at 50° C.	Mixture of industrial oil Grade 50 (60 per cent) and spindle oil Grade AY (40 per cent) Engler viscosity 3.5 — 4.5° at 50° C.
H	Transmission oil	
C	Grease. Melting point 75° C. Penetration 270—330 at 25° C.	Grease. Melting point 70° C. Penetration 330—360 at 25° C.
y	Universal, water-resistant grease with high melting point (120°). Penetration 175—210 at 25° C.	
T	Brake fluid (Substitute 50 per cent castor oil and 50 per cent alcohol).	
A	Spindle oil Grade AY. Engler viscosity 2.05—2.36° at 50° C.	
P	Graphite lubricant	
AM	Grease. Melting point 115° C. Penetration 220—270 at 25° C.	

EXPLANATORY NOTES TO LUBRICATION CHART

1. **Engine crankcase.** Check oil level daily. Change oil every 1,500 or 2,000 km.
2. **Steering gear case.** Check oil level and top up, if necessary. Change oil in spring and fall.
3. **Generator** — 2 oilers, 5 drops each.
4. **Front wheel hub bearings.** Change lubricant.
5. **Steering knuckle pin.**
6. **Course oil filter.** Drain sediment when changing crankcase oil.
7. **Ignition distributor.** Rotate oiler on distributor body one turn.
8. 2 drops of engine oil on breaker arm pivot and cam brush.

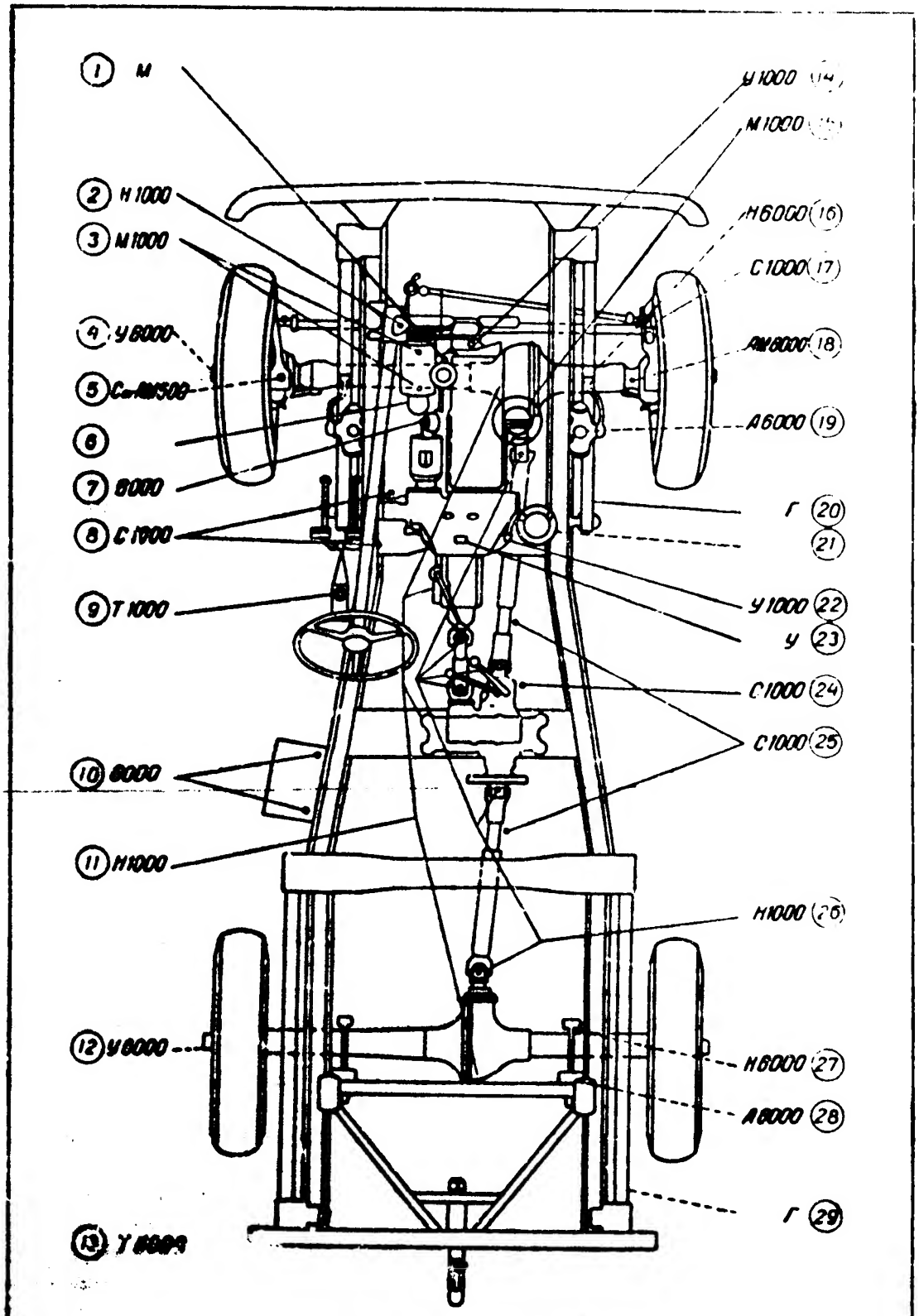


Fig. 6. Lubrication Chart

8. **Pedal shaft and clutch release drive shaft.**

9. **Brake master cylinder.** Check fluid level and bring it to 20 mm below filler hole rim. Do not use mineral oils.

10. **Storage battery terminals.** Coat with vaseline at least twice a year.

11. **Transmission, transfer case, front and rear axle casings.** Check oil level and top up, if necessary. Change oil every 6000 km and every spring and fall.

12. **Rear wheel hub bearing.** Change lubricant.

13. **Accelerator shaft bearings** — 2 or 3 drops.

14. **Water pump bearings.**

15. **Carburettor air cleaner.** Flush out and change oil. Under severe dust conditions clean daily.

16. **Shock absorber bracket hinges.**

17. **Steering rod joints.**

18. **Steering knuckle joints.** Add 150 g. In spring and fall or every 12,000 km flush out knuckles and pack 300 g of lubricant.

19. **Front shock absorber housings.** Add fluid. Once a year remove, flush out and replace fluid.

20. **Front spring leaves.** Lubricate when necessary but not less than twice a year.

21. **Fine oil filter.** Drain sediment every 1000 km and each time when changing crankcase oil. Replace filter element every 1,500 or 2,000 km simultaneously with changing crankcase oil.

22. **Clutch release bearing.** Turn oil cup cover two or three turns.

23. **Drive gear shaft bearing.** Pack with lubracant during overhaul.

24. **Transfer case lever shaft.**

25. **Splines of front and rear propeller shafts.** 2 or 3 shots of a grease gun.

26. **Joints of front, rear and intermediate propeller shafts.** Lubricate with fluid oil only.

27. **Shock absorber bracket hinges.**

28. **Rear shock absorber housings.** Add fluid. Once a eyar remove, flush out and refill.

29. **Rear spring leaves.** Lubricate when necessary but not less than twice a year.

In addition to operations listed in Lubrication Chart do the following:

1. Every 2,000 km change engine crankcase oil. If the filter element has not been replaced and the crankcase oil becomes cloudy, change oil every 1,000 km. Drain oil from the crankcase and filters immediately after stopping the engine. Simultaneously with changing the crankcase oil clean both oil filters.

2. If the engine crankcase becomes excessively dirty flush it out with fluid oil. To do this pour in 3 litres of oil, remove the spark plugs

and turn the crankshaft in the course of 1 or 2 min. Drain and refill with fresh oil.

3. Simultaneously with changing crankcase oil replace fine oil filter element.

4. Change oil in the air cleaner simultaneously with changing the crankcase oil. If the air cleaner, screen becomes clogged flush it out in kerosene, blow out with compressed air and dip in fresh oil. When working over dusty roads change oil in the cup daily.

5. Pack water pump bearings with lubricant until it oozes through the check hole. Wipe off excess lubricant.

6. In spring and fall change lubricant in the cases of transmission, transfer case, front and rear axles. If the oil is heavily contaminated, flush out the cases with kerosene. To flush — pour 1 or 1,5 liters of kerosene into the case, jack up the wheels, start the engine and allow it to run for 2 or 3 min, then drain kerosene and refill with fresh oil.

Refill the cases of the transmission, transfer case, front and rear axles to the level of the filler plugs, using a special oil gun.

7. Every season change oil in the steering gear case. To drain - remove the lower R. H. bolt of the front cover. Refill to the level of the filler plug.

8. Universal joints of the needle bearing type are lubricated with fluid oil. Force the oil in by an oil gun fitted with a special end piece until the oil appears from the valve located on the crosspiece.

Lubricate the propeller shaft splines by applying two or three shots of the lubricating gun.

9. The pin of the transfer case levers, shock absorber bracket joints, steering rod pivots and pedal shaft should be packed with grease until it oozes from the joints.

10. When changing lubricant in wheel hubs, flush out the hubs and bearings, then pack the bearings and hub with grease. The layer of lubricant in the hub should be 10 to 15 mm thick.

11. The pivots of the front and rear shock absorber brackets should be lubricated simultaneously with wheel hubs because access to bracket grease fittings is possible with removed wheels only. Every 6,000 km apply two or three shots of lubricating gun using fluid lubricant; remove excess lubricant.

12. Clutch release bearing should be lubricated by screwing in the lubricator cap two or three turns.

13. Every 6,000 km add fluid into the shock absorbers to the filler plug level. Once a year remove the shock absorbers and flush them out with gasoline. Place new 0.8 mm gaskets under valve plugs.

14. As the lubricant in the oil cups of the clutch release bearings and distributor shaft is used up, remove the oil cups and pack with fresh lubricant.

15. Fill the distributor oil cup with lubricant. Apply engine oil to the breaker arm pivot and felt wick.

CARE AND SERVICE ADJUSTMENTS

ENGINE

The automobile is powered with a four cylinder, four-stroke cycle gasoline engine. The design of the engine is shown in Figs. 7 and 8

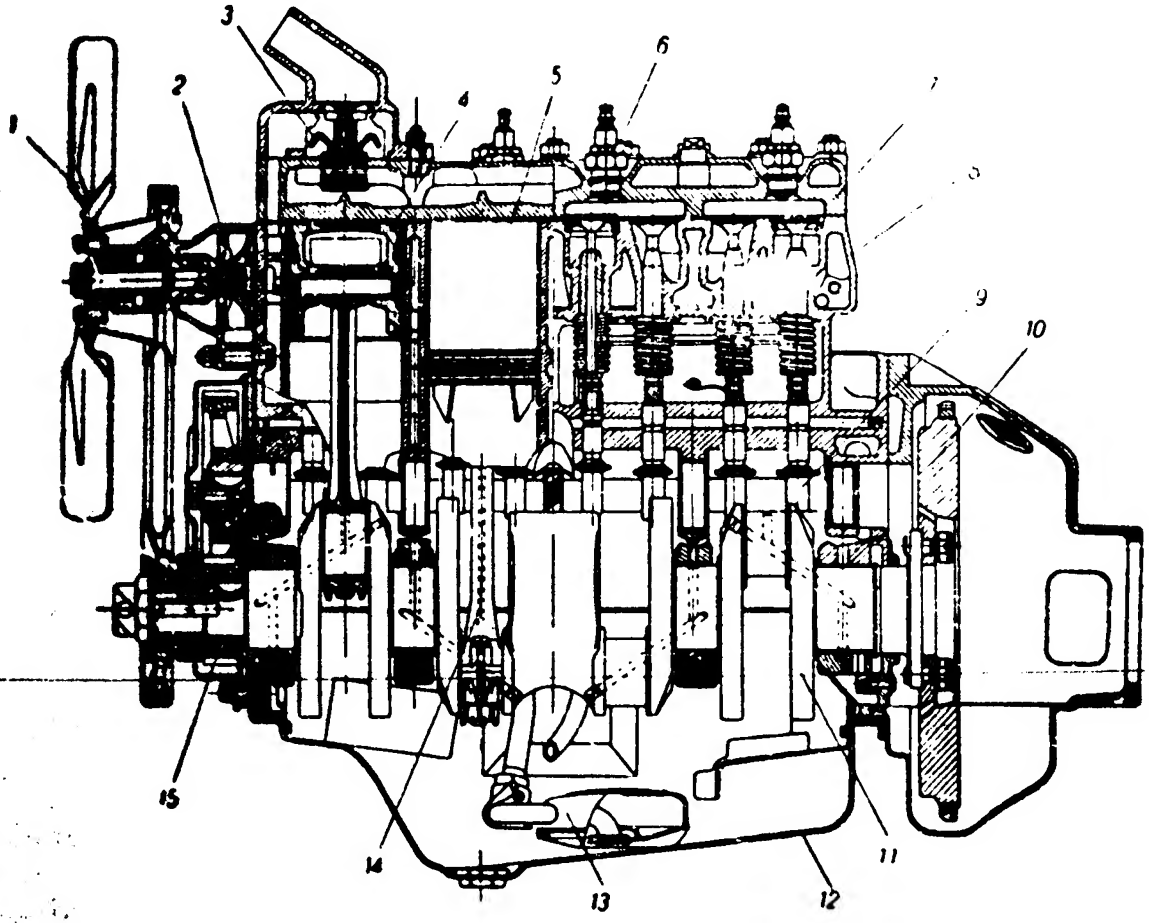


Fig. 7. Engine Longitudinal Section

1 — fan, *2* — water pump, *3* — thermostat, *4* — piston, *5* — cylinder liner, *6* — spark plug, *7* — cylinder head, *8* — cylinder block, *9* — camshaft, *10* — flywheel, *11* — crankshaft, *12* — crankcase, *13* — oil suction bell, *14* — connecting rod, *15* — timing gears.

CARE OF THE ENGINE

cylinder head bolt nuts every 1,000 km and after each
of the cylinder head.
carbon deposits from the cylinder head and piston

of carbon may be diagnosed by detonation noises, engine
loss of power, excessive gasoline and oil consumption.
the cylinder head and scrape off the carbon deposits.

3. Every 40,000 to 50,000 km the piston rings and connecting rod bearing shells should be replaced by new parts of repair size. Word piston rings cause loss of power, increase oil consumption, reduce

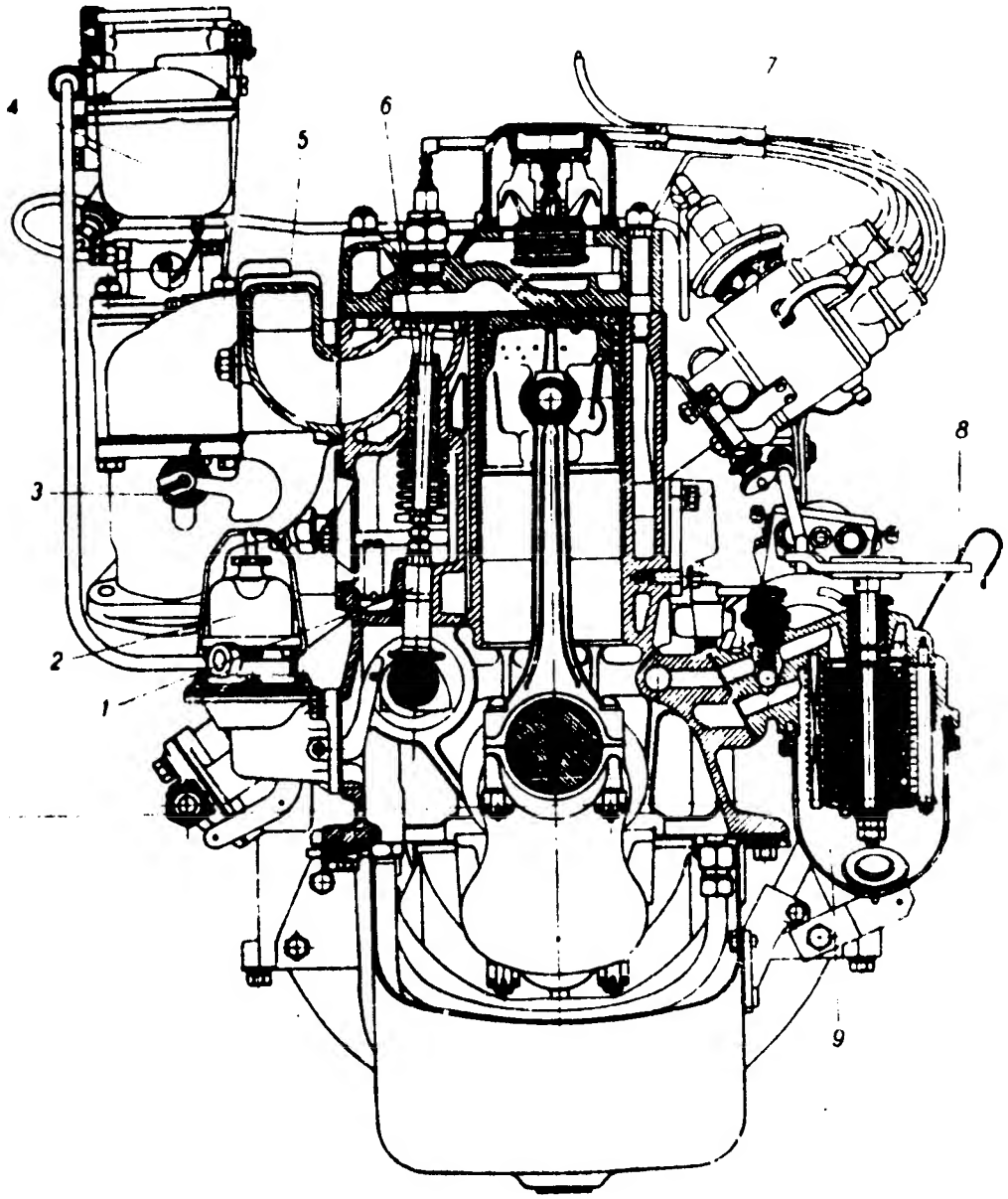


Fig. 8. Engine Cross Section

1 — valve filter, 2 — fuel pump, 3 — mixture heating regulator, 4 — carburettor, 5 — manifold, 6 — valve, 7 — ingnition distributor, 8 — oil dipstick, 9 — coarse oil filter.

compression, result in heavy smoking through crankcase vent hole; besides, the carburettor becomes restricted with resinous residue.

When replacing piston rings remove carbon deposits from the piston ring grooves and from the holes in the oil control ring grooves.

Depending on the degree of wear the connecting rod shells must be replaced by new standard or 0,05 mm undersized shells.

4. If valve knocking is discovered adjust the valve to lifter clearances in the following sequence:

a) Jack up the front axle, place it on some support, remove the right front wheel and mudguard;

b) Remove the valve box covers;

c) Bring No. 1 piston to TDC on the compression stroke, turning the crankshaft until the ball on the flywheel coincides with the pointer on the clutch housing;

d) Check the clearances of No. 1, 1, 4 and 6 valves by a feeler gauge. On a cold engine the clearances should be 0.23 mm for inlet valves and 0.28 mm for exhaust valves. On a warm engine — 0.20 mm and 0.25 mm, respectively;

e) To adjust clearances hold the lifter by a wrench, loosen the lock nut and turn the adjusting screw, as necessary. Having adjusted the clearance tighten the lock nut and recheck clearance.

f) Turn the crankshaft through one complete revolution. Check and adjust the clearances of the remaining valves, if necessary.

COOLING SYSTEM

The engine is equipped with a forced water circulation system. To maintain normal engine operating temperature (80 to 90°) and to improve warming up, the cooling system is equipped with a thermostat located in the cylinder head pipe union and a radiator blind controlled by the handle from the driver's seat. Pulling the handle out closes the blind, and pressing it in opens the blind.

The thermometer unit for the control of engine temperature is installed in the cylinder head. Besides, there is a green tell-tale light flashing on when the temperature of water increases up to 92—98° C.

To reduce formation of scale fill the cooling system with soft water with small salt content.

In winter it is recommended to use liquids with a low freezing point — »antifreeze», consisting of ethylene-glycol (55 per cent) and water.

When the automobile is parked for a long time in a cold place drain water from the cooling system through two cocks: one located on the lower radiator tank, and the other — on the starting heater tank. When draining remove the radiator cap.

The radiator cap (Fig. 9) seals the radiator hermetically, and connects the cooling system with outside air through two valves. The steam outlet valve opens at an over-pressure of 0.28 to 0.38 kg/sq. cm. The inlet valve opens when the vacuum in the system reaches 0.01 to 0.13 kg/sq. cm and admits outside air.

The water pump (Fig. 10) is of a centrifugal type. It is sealed by a self-adjusting seal. Dribbling of water through the check hole shows

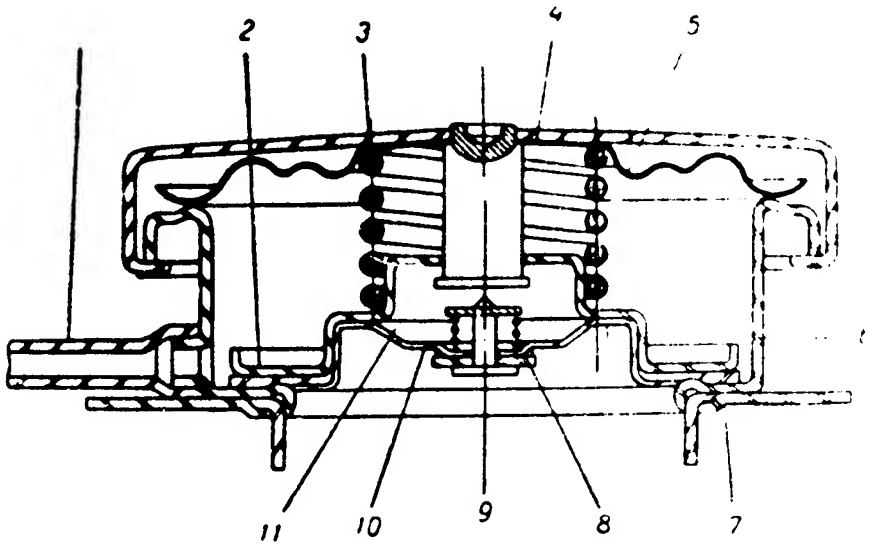


Fig. 9. Radiator Filler and Cap

1 — control pipe, 2 — outlet valve, 3 — outlet valve spring, 4 — cap body, 5 — neck spring, 6 — radiator filler neck, 7 and 8 — gaskets, 9 — inlet valve, 10 — inlet valve spring, 11 — inlet valve body.

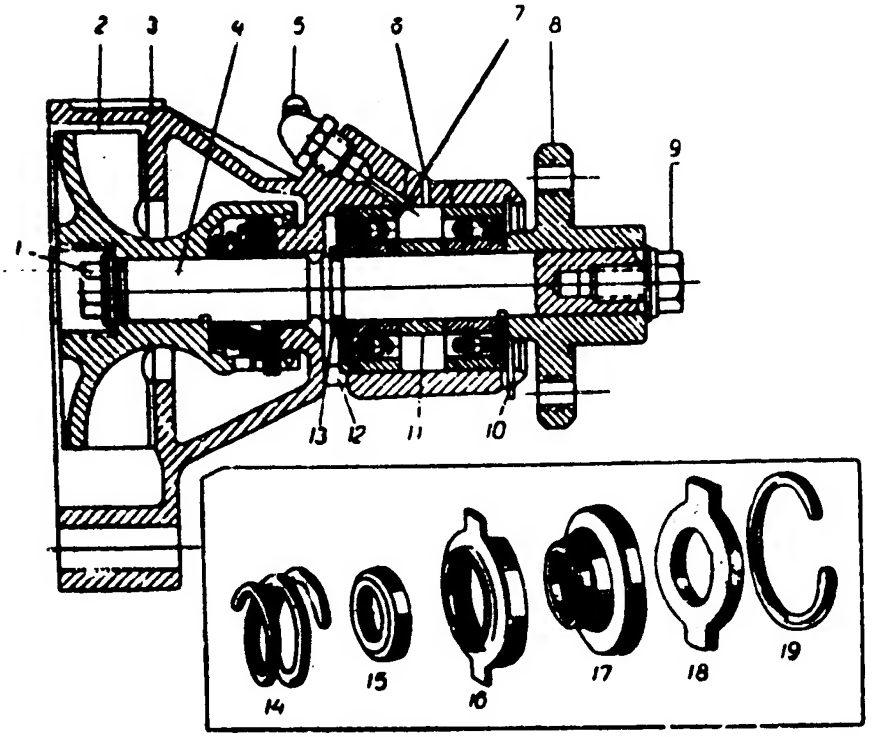


Fig. 10. Water Pump

1 — impeller attachment bolt, 2 — impeller, 3 — water pump body, 4 — shaft, 5 — grease fitting, 6 — bearing check hole, 7 — pump bearings, 8 — fan hub, 9 — bolt, 10 — bearing outer retainer ring, 11 — spacer, 12 — water drain hole, 13 — inner retainer ring, 14 — seal spring, 15 — inner seal case, 16 — outer seal case, 17 — rubber collar, 18 — textolite washer, 19 — seal retainer ring

that the seal needs servicing. The water pump bearings are lubricated through a grease fitting until the lubricant emerges from the joints.

To repair the seal remove the water pump from the engine and press out the pump impeller together with the seal using the puller tool shown in Fig. 11.

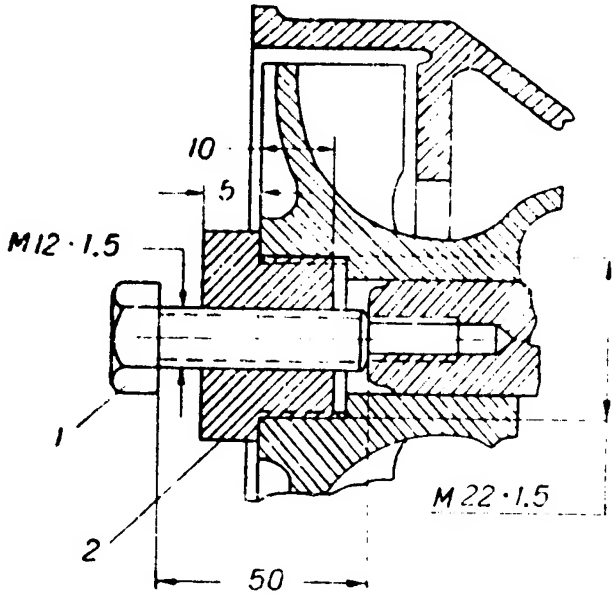


Fig. 11. Removing Water Pump Impeller

1 — puller screw, *2* — puller nut.
Dimensions are shown in mm.

To facilitate the starting of the engine in winter the automobile is equipped with a starting heater installed on the left-hand side of the engine.

The care of the cooling system is confined to regular removal of scale, adjustment of fan belt tension and regular lubrication of the water pump bearing.

It is recommended to flush out the system by a powerful jet of clean water with disconnected hoses. The radiator should be flushed out through the lower pipe union. The engine water jacket should be flushed out through the upper pipe union with the thermostat removed.

Fan belt tension is adjusted by turning the generator. The normal slack of the belt is 12 to 20 mm.

LUBRICATING SYSTEM (Fig. 12)

The engine is provided with a lubricating system of a combination type. The crankshaft and camshaft bearings and valve lifters are forced lubricated. Other parts are splash lubricated.

The oil is poured into the engine crankcase through the filler pipe closed hermetically by the cap. From the crankcase the oil is drawn through the floating oil suction bell into the gear oil pump installed

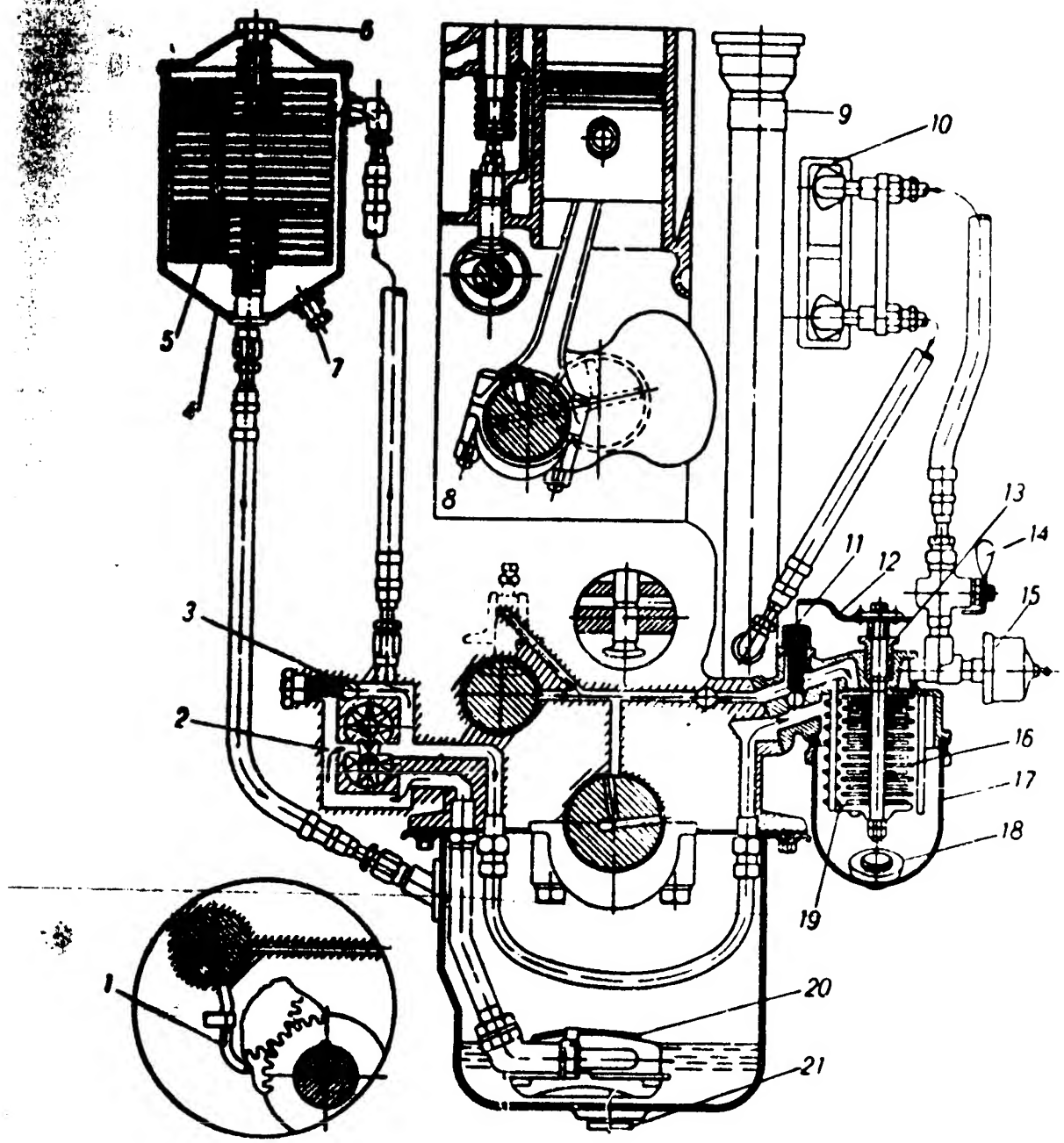


Fig. 12. Engine Lubrication Diagram

1 — timing gear lubricating pipe, *2* — oil pump, *3* — relief valve, *4* — fine oil filter, *5* — filter element, *6* — filter cover bolt, *7* — drain plug, *8* — lubrication of camshaft cams and cylinder walls, *9* — oil filler pipe, *10* — oil cooler, *11* — bypass valve, *12* — coarse oil filter lever, *13* — seal, *14* — oil cooler cock, *15* — oil pressure gauge unit, *16* — coarse oil filter, *17* — filter sediment bowl, *18* — coarse oil filter drain plug, *19* — filter plates, *20* — oil suction bell, *21* — crankcase drain plug.

on the outside of the engine crankcase and developing a pressure of 2 to 4 kg/sq. cm. The oil is filtered twice, in coarse and fine oil filters. It is necessary for the coarse oil filter to rock the coarse oil filter lever 16—20 times daily. The crankcase ventilation is of a forced type. The

cooling of oil is ensured by the oil cooler controlled by the cock installed near the coarse oil filter. Operation of the lubricating system is controlled by the oil pressure gauge.

There are two valves in the engine lubricating system: the relief valve installed on the oil pump cover which limits maximum pressure;

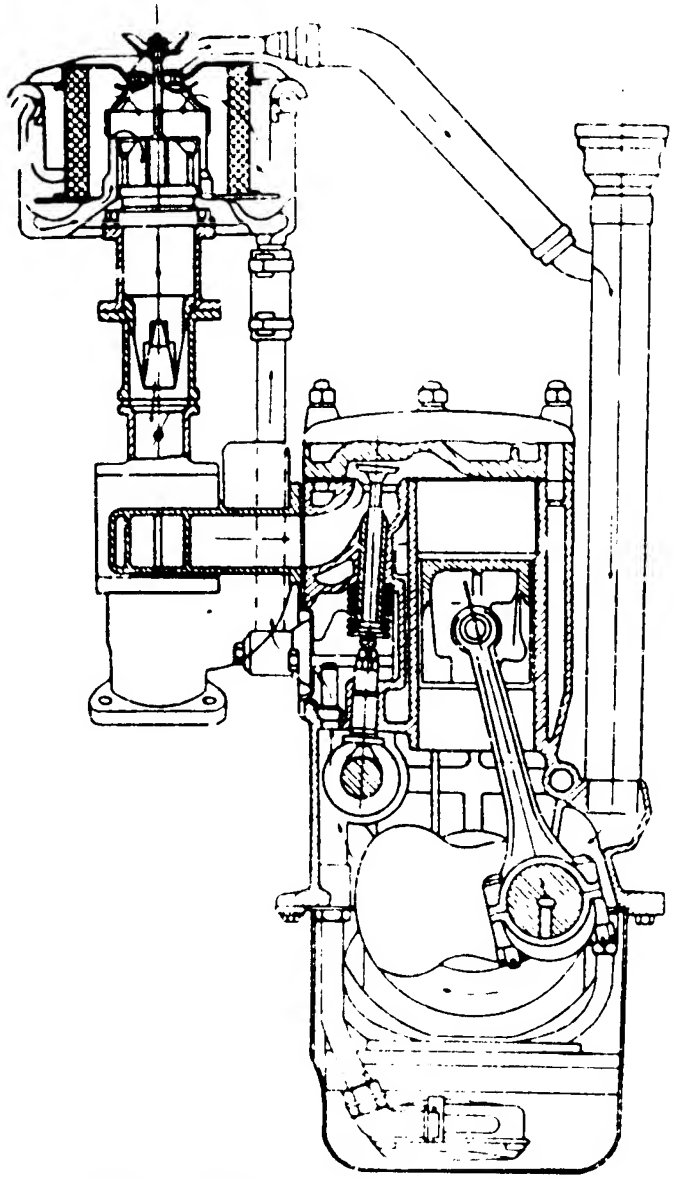


Fig. 13. Engine Crankcase Ventilation

and the bypass valve located on the coarse oil filter, which ensures circulation of oil should the filter become clogged.

A sudden oil pressure drop may be caused by the blockage of the relief valve. In this vase remove the oil pump cover, dismantle and flush out the relief valve. Before replacing the pump cap lubricate the pump gears with grease, otherwise the pump will not draw the oil from the crankcase.

The crankcase oil level is measured by the oil dipstick. The oil level should be between the »O» and »П» marks.

The oil cooler should be turned ON in summer and when the engine is working under heavy load.

The replaceable element of the fine oil filter should be changed each time when the crankcase oil is changed or at an earlier date when the oil shows an evidence of being murky or cloudy.

Replace the filter element as follows:

1. Mark the position of the filter cap on the body, and remove the cap.
2. Remove the drain plug, drain sediment and wipe the body.
3. Replace the filter element, screw IN the plug and refill the filter with fresh oil.
4. Check condition of the body cap gasket and change it if necessary.
5. Replace the cap.
6. Add oil into the engine crankcase to the »П» mark on the dipstick.
7. Start the engine, check for oil leaks and add oil to the »П» mark.

Engine crankcase ventilation (Fig. 13) operates due to a difference in the vacuum in two points of the air cleaner to which inlet and outlet tubes are connected. Ventilation cleans the crankcase from gasoline vapours and exhaust gases that break through the piston rings.

Do not operate the engine with insufficiently tight ventilation system as this will result in dust getting inside the crankcase.

Check the ventilation system regularly for tightness and remove sludge.

A normal engine oil pressure should be 2 to 4 kg/sq.cm at a speed of 45 km/hr. On a cold engine the pressure may reach 4,5 kg/sq.cm and drop down to 1.5 kg/sq.cm in hot waether. At low idle speed the minimum oil pressure should be equal to at least 0.5 kg/sq.cm.

A drop of pressure below 1,0 kg/sq.cm at medium speed shows that something is out of order in the system.

FUEL SYSTEM (Fig. 14)

The fuel system consists of fuel tanks, filter-sediment bowl, fuel pump, carburettor, air cleaner, inlet manifold and connecting pipes.

The automobile is equipped with either two fuel tanks (ГАЗ-69) or one fuel tank (ГАЗ-69А). The tanks are equipped with air-tight caps provided with double valves which prevent loss of gasoline vapours. The tank is equipped with a shut-off valve, two gasoline level indicators (dipstick and electric type) and a drain plug. With a two-tank arrangement a three-way cock is installed used for switching over from the main tank to the auxiliary tank. The care of the tank consists in regular inspection and flushing out of the cap valves; draining sediment and flushing out the tank.

The filter-sediment bowl of a plate type is installed on the left-hand side of the automobile frame. The care of the sediment bowl consists in regular draining of sediment through the drain plug and periodical washing of the filter element.

The fuel pump of a diaphragm type has a hand lever for priming gasoline. On the running engine the hand priming lever should be held down by a spring.

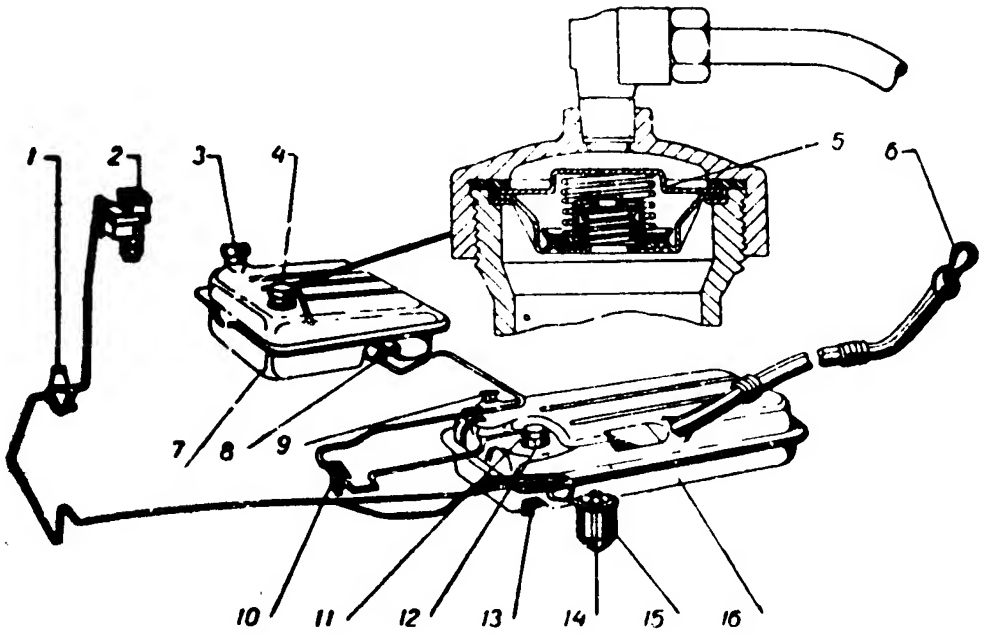


Fig. 14. Fuel System

1 — fuel pump, *2* — carburettor, *3* — and *6* — fuel tank filler caps, *4* — valve pipe plug, *5* — inlet and outlet valve assembly, *7* — auxiliary tank, *8* — shut-off valve, *9* — gasline level dipstick, *10* — three-way cock, *11* — outlet pipe, *12* — gasoline level indicator rheostat, *13* — tank drain plug, *14* — filter-sediment bowl drain plug, *15* — filter-sediment bowl, *16* — main fuel tank.

The care of the fuel pump consists in regular washing of the screen filter installed in the upper part of the pump and replacement of the cork gasket, should it become damaged.

The automobile is equipped with a K-22Д down-draft carburettor with automatic mixture control effected by two jets and elastic Venturi tubes. The carburettor is fitted with an acceleration pump, economizer mechanically driven from the throttle valve, and a needle for adjusting the carburettor under operational conditions. The diagrammatic view of the carburettor is shown in Fig. 15.

The carburettor has a provision for four types of adjustment: the metering system is adjusted by turning the needle of the main jet; acceleration pump is adjusted by means of the pump drive lever; economizer is adjusted by screwing the nut on the accelerator rod; and the idle speed is adjusted by the screw located in the idle speed passage and the screw controlling the opening of the throttle valve.

The economizer starts to operate when the throttle valve lever is 6.2—6.8 mm short of the stop, The moment of switching on of the economizer is adjusted by turning the nut on the acceleration pump rod. See that the economizer drive rod is connected to the end hole of the lever.

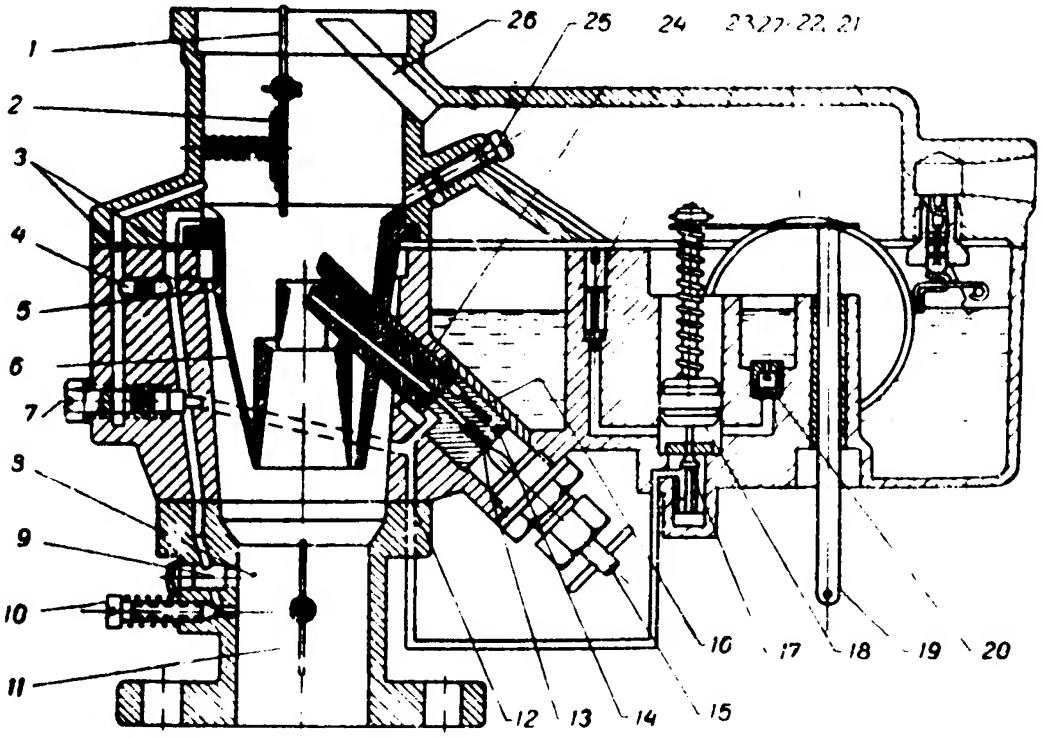


Fig. 15. Carburettor Diagram

1 — choke, *2* — choke safety valve, *3* — idle speed air jets, *4* — idle speed emulsion jet, *5* — Venturi block, *6* — Venturi spring plates, *7* — idle speed jet, *8* — vacuumatic governor tube hole, *9* — idle system upper outlet opening (slot), *10* — idle speed adjusting screw, *11* — throttle valve, *12* — gaskets, *13* — main jet, *14* — compensating jet, *15* — main jet adjusting needle, *16* — jet block, *17* — economizer valve, *18* — acceleration pump piston, *19* — acceleration pump drive rod *20* — acceleration pump return valve, *21* — float chamber needle valve consists of the valve, spring and rod, *22* — float, *23* — accelradion uuusp valve, *24* — atomizer block, *25* — acceleration pump jet, *26* — balancing tube, *27* — economizer adjusting nut.

Adjustment of the idle speed is carried out on a warmed-up engine subsequent to checking the ignition system.

Turning the throttle valve screw IN (Fig. 16) opens the throttle and increases engine speed. Turning the idle speed screw OUT increases the quantity of the fuel mixture.

Before making adjustments, turn the throttle valve screw IN 1 1/4 or 2 turns and turn the idle speed screw OUT also 1 1/2 or 2 turns.

To adjust:

1. Turn the throttle valve screw OUT to set the minimum steady idle speed.

2. Turning the idle speed screw IN, make the mixture leaner until the engine begins to misfire, then back it off a little for smooth engine performance.

3. Check adjusment by depressing the accelerator pedal and releasing it abruptly. If the engine stalls increase engine speed by turning the throttle valve screw IN 1/2 of a turn.

The working mixture is heated by the exhaust gases in the middle part of the inlet pipe. Intensity of heating is controlled by the choke operated automatically by means of a bimetal spring and weight.

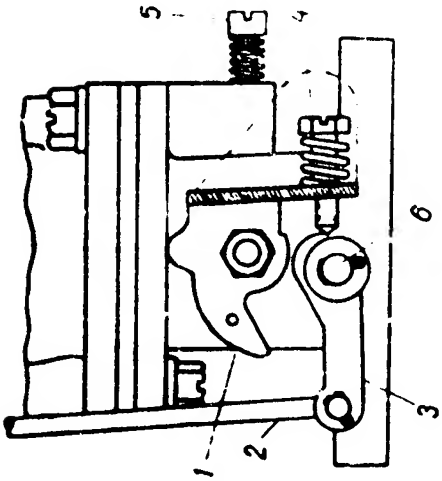


Fig. 16. Linkage rom Choke to Throttle Valve

1 — throttle valve lever, 2 — choke to throttle rod, 3 — lever with cam, 4 — screw adjusting opening of throttle valve at idle speed, 5 — idle speed adjusting screw, 6 — pin.

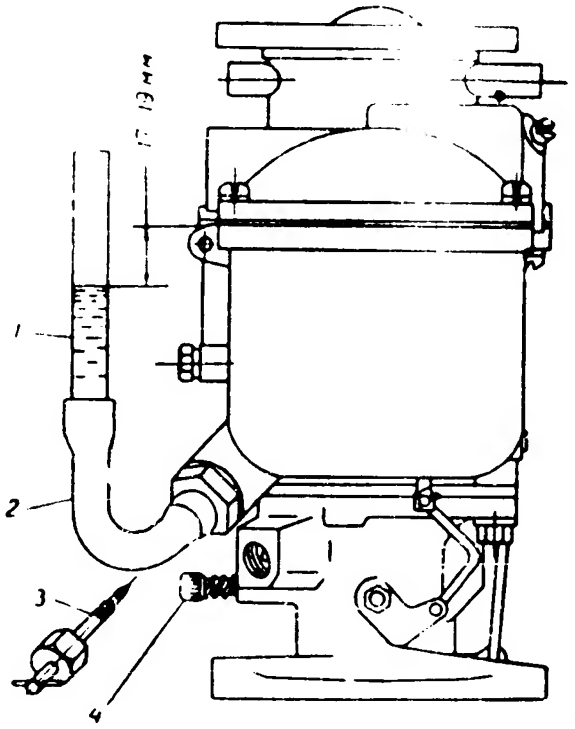


Fig. 17. Measuring Gasoline Level in Float Chamber

1 — glass tube, 2 — rubber pipe, 3 — adjusting needle, 4 — idle speed screw.

Fuel consumption during operation depends on the condition of the automobile and proper adjustment of the fuel system.

Condition of the running gear can be determined to a considerable extent by free running. The automobile running over a level road at a speed of 30 km/hr must cover at least 150 m from the time the clutch is released to the complete stop.

The length of the free run depends on the lubrication of the running gear, adjustment of wheel bearings and brakes, and condition of tyres.

Fuel consumption is considerably influenced by correct setting of the ignition advance angle. The ignition should be set so that with the engine running on gasoline of 66—70 octane number, infrequent detonation knocks will be heard if the automobile has been accelerated in first gear by abrupt depression of the accelerator pedal.

To bring fuel consumption to a minimum it is necessary to adjust properly the opening of the carburettor main jet needle. It is recom-

mended that the needle be opened 1 1/2 or 2 turns, depending on operational conditions.

Adjust correct gasoline level in the float chamber. Checking is effected by means of two tubes made of rubber and glass screwed into an opening in the adjusting needle (Fig. 17). Normally, the gasoline level should be 17 to 19 mm below the carburettor split surface. To change the level bend the tongue on the lever to which the float is soldered.

The care of the carburettor consists in regular washing and blowing out of jets, cleaning the Venturi plates from deposits, inspecting the gaskets and checking carburettor adjustments.

IGNITION SYSTEM

The ignition system consists of a 12 V storage battery, generator, ignition switch, ignition coil, distributor-breaker and spark plugs. The ignition wiring system is shown in Fig. 18.

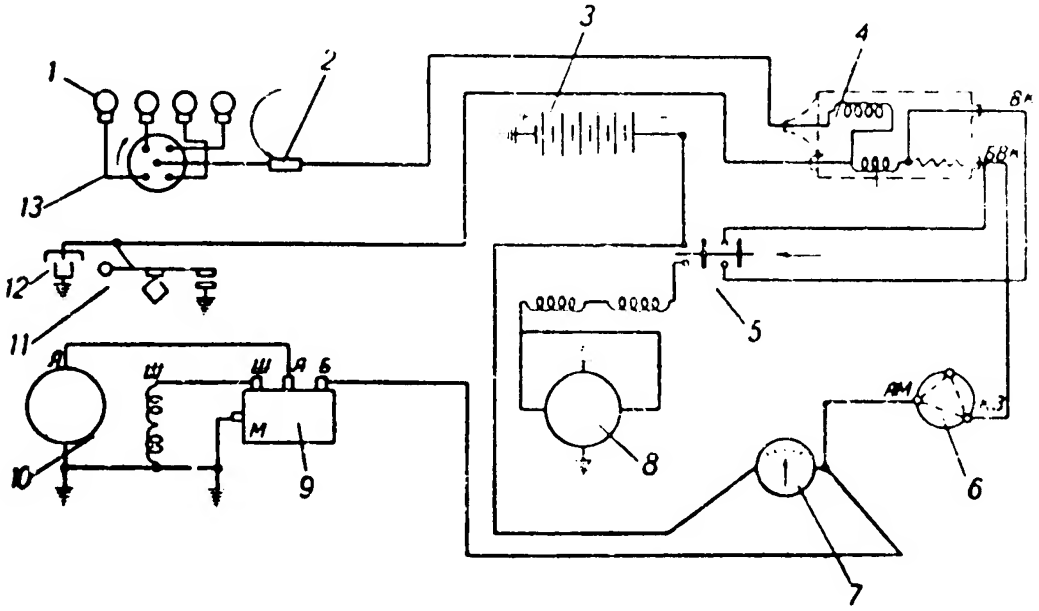


Fig. 18. Ignition Wiring System

1 — spark plugs, *2* — suppressor resistor, *3* — storage battery, *4* — ignition coil, *5* — starter switch, *6* — ignition switch, *7* — ammeter, *8* — starting motor, *9* — current and voltage regulator, *10* — generator, *11* — breaker, *12* — condenser, *13* — distributor.

The spark plugs of M12Y type with 18 × 1.5 mm thread are used. When replacing a spark plug see that the length of the threaded part does not exceed 12 mm. A normal electrode gap is 0.7 to 0.8 mm. Adjust the spark plug gap by bending the side electrode only.

The ignition coil of Б 1 type is equipped with an additional resistor closed by the starter switch during engine starting.

The H. T. circuit includes suppressor resistors to reduce radio interference created by the operation of the ignition system.

The P-20 distributor with the centrifugal and vacuumatic spark

advance control and octane-selector (Fig. 19) is installed on the L. H. side of the engine being driven by the oil pump shaft.

The care of the ignition system consists in regular inspection of spark plugs, adjustment of the spark plug gap, replacement of faulty

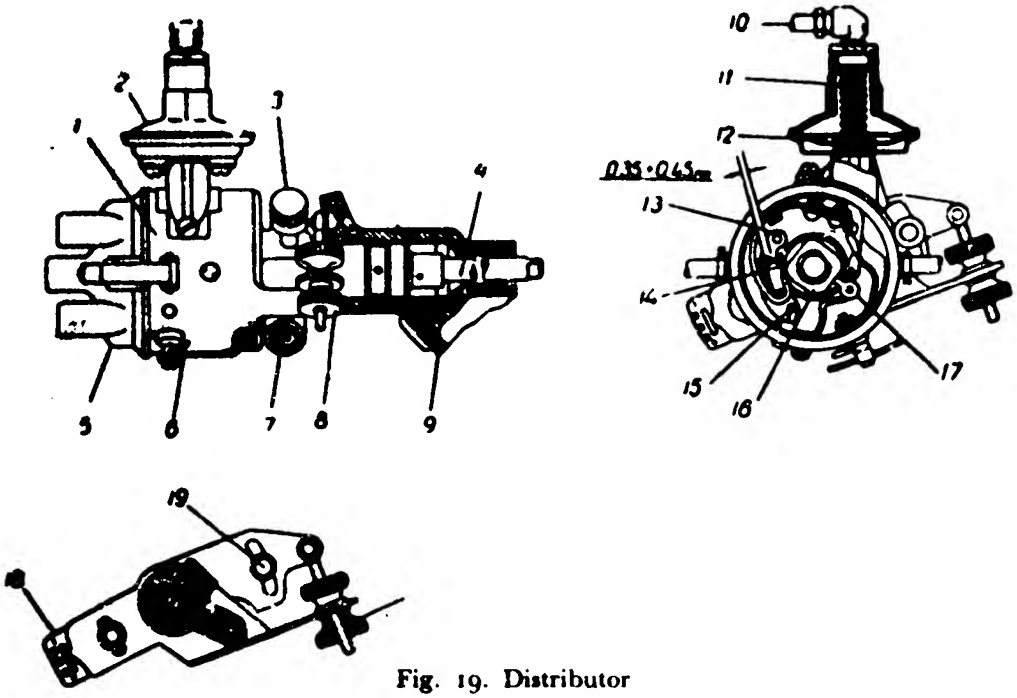


Fig. 19. Distributor

1 — distributor body, *2* — vacuumatic spark advance unit body, *3* — oiler, *4* — distributor shaft, *5* — cap, *6* — L. T. terminal, *7* — condenser, *8* — octane selector nuts, *9* — cylinder block, *10* — vacuumatic unit tube, *11* — spring, *12* — vacuumatic unit diaphragm, *13* — breaker fixed contact plate screw, *14* — breaker arm, *15* — adjusting eccentric screw, *16* — breaker cam, *17* — felt wick, *18* — octane selector scale, *19* — distributor to cylinder block attachment screw.

or soiled spark plugs, checking and adjusting the breaker point gap, cleaning the breaker points, setting the ignition, timely lubrication of the distributor and servicing the current source and wiring (see Electric Equipment Section).

To adjust the breaker point gap crank the engine by the starting handle to set the breaker points to maximum opening position, then loosen the screw of the fixed contact plate and turn the adjusting eccentric screw to set the required clearance by means of a feeler gauge.

While adjusting inspect and clean the points by a special plate included in the Driver's Kit.

The ignition is set using the notches on the flywheel. A ball pressed into the flywheel corresponds to TDC in cylinder No. I. In addition there are divisions ± 12° from TDC.

Set the ignition as follows:

1. Remove the distributor cap and check the breaker point gap.
2. Remove the cover of the access hole on the flywheel near the starter.

3. Remove No. I spark plug.

4. Place the thumb over the spark plug hole and crank the engine slowly until the compression stroke is felt.

5. Continue to crank the engine slowly until the notch on the flywheel (marked by figure 4) is lined up with the pointer on the clutch housing.

6. Disconnect the tube of the vacuumatic control.

7. Remove the distributor cap and make sure that the rotor contact lines up with No.I spark plug contact in the distributor cap.

8. Set the octane selector to the zero division by means of adjusting nuts.

9. Loosen the distributor to cylinder block attaching screw and turn the distributor body clockwise so as to close the contacts.

10. Switch ON the inspection lamp, connecting one lead to the ground and the other one to the L. T. terminal of the ignition coil.

11. Turn the ignition switch ON and rotate slowly the distributor body counter-clockwise until the lamp flashes up.

12. Secure the distributor body to the cylinder block by screws, replace the distributor cap and insert the central cable. Inspect the order of H. T. cable connection, beginning with cylinder No. I. The cables should be connected in the order 1—2—4—3 in a clockwise direction.

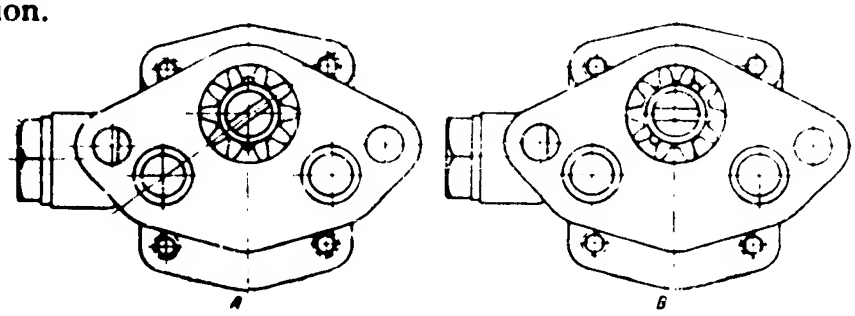


Fig. 20. Position of Oil Pump Shaft Slot

(viewed from above)
A — prior to installation in cylinder block.
B — after installation.

The final adjustment of ignition setting is carried out during road tests with the engine running on gasoline of 66—70 octane number. For this purpose drive the warmed up automobile in high gear at a speed of 25 -30 km/hr and depress sharply the accelerator pedal as far as it will go. If weak detonation knocks are heard, the ignition is now considered timed. If detonation is strong turn the distributor body clockwise one division of the octane-selector scale. If there is no detonation turn the distributor body counter-clockwise.

If the oil pump has been removed from the engine, correct coupling of its shaft with the distributor shaft should be achieved by installing the oil pump as follows:

1. Bring the engine crankshaft to a position corresponding to TDC on the compression stroke in cylinder No. 1.

2. Turn the oil pump shaft so its slot is brought to the position shown in Fig. 20, A.

3. Put the oil pump in place carefully so that the pump gears will mesh with the camshaft gear, the pump shaft will turn and the slot for the distributor shaft lug will take a horizontal position, shown in Fig. 20, B.

POWER TRANSMISSION

The power transmission of the automobile comprises the clutch, transmission, transfer case, propeller shaft, front and rear axles.

CLUTCH (Fig. 21)

The clutch is the dry, single plate type with a vibration damper. The care of the clutch consists in adjusting the play of the clutch pedal and regular lubrication of the release collar bearing, release

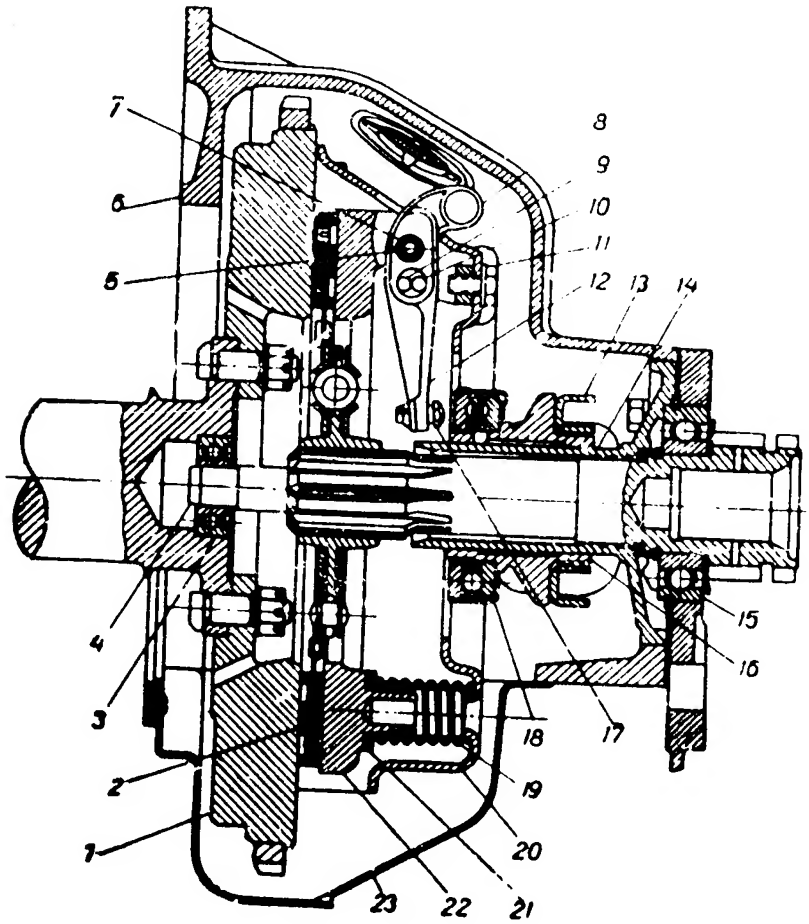


Fig. 21. Clutch

1 — flywheel, 2 — driven plate, 3 — clutch shaft front bearing, 4 — clutch shaft, 5 — pull back lever pin, 6 — clutch housing, 7 — needle bearing, 8 — weights, 9 — pin, 10 — roller, 11 — pull back lever bracket, 12 — pull back lever, 13 — engagement fork, 14 — front transmission cover, 15 — bearing, 16 — engagement sleeve, 17 — pull back lever adjusting screw, 18 — thrust bearing, 19 — spring, 20 — housing, 21 — washer, 22 — pressure plate, 23 — clutch lower housing.

shaft and clutch pedal pin. The play of the clutch pedal should be 38 to 45 mm. Play is adjusted by changing the length of the pusher connecting the release yoke with the clutch release shaft lever (Fig. 22). Adjustment by the use of the pull back lever adjusting bolt should be avoided.

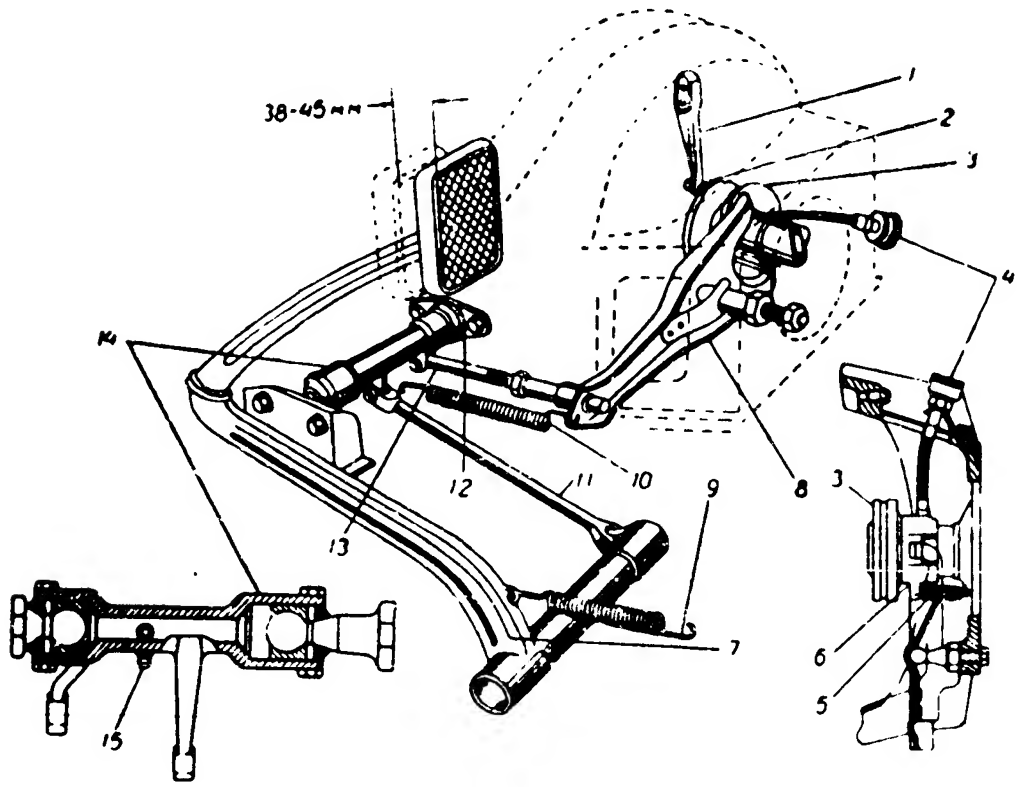


Fig. 22. Clutch Release Linkage

1 — pull back lever, *2* — pull back lever adjusting screw, *3* — thrust bearing, *4* — oiler, *5* — release collar retracting spring, *6* — release collar, *7* — clutch pedal, *8* — release fork, *9* — clutch pedal return spring, *10* — release fork pull back spring, *11* — clutch release shaft rod, *12* — clutch release shaft bracket support on engine, *13* — release fork pusher, *14* — clutch release shaft, *15* — shaft oiler.

The clutch release bearing is lubricated through an oil cup located on the R. H. side of the clutch housing. The release shaft and clutch pedal pin are lubricated through grease fittings.

TRANSMISSION (Figs. 23 and 24)

The two-range gearbox has three speeds forward and one reverse. The constant mesh and 2nd speed gears have helical teeth, while the 1st speed and reverse speed gears have straight teeth. The 2nd and high gears are fitted with synchronizers. The gear shift mechanism and lever are mounted in the side cover.

To ensure proper synchronizer operation and noiseless shifting of **gears the gear shift lever should** be moved smoothly, without jerks. **Shift from the 2nd speed to the 1st** only after reducing the automobile **speed down to 5 km/hr.**

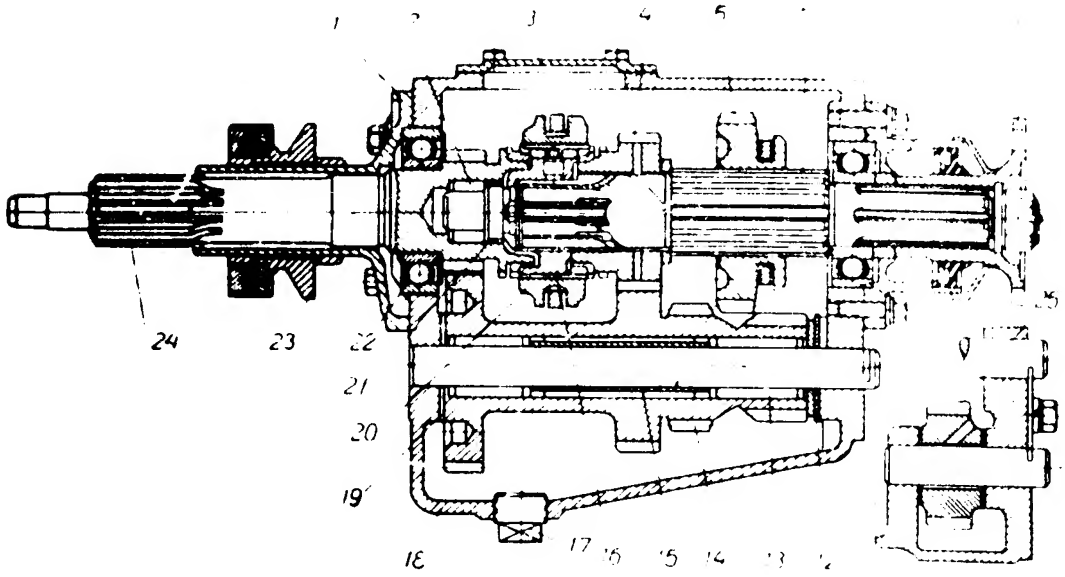


Fig. 23. Transmission. Longitudinal Section

1 — front bearing cap, *2* — roller bearing, *3* — upper cover, *4* — 2nd speed gear, *5* — 1st speed and reverse speed slide gear, *6* — main shaft, *7* — rear cover, *8* — bearing spacer ring, *9* — propeller shaft attachment flange, *10* — ball bearing, *11* — countershaft pivot, *12* — and *19* — thrust washers, *13* — roller bearing, *14* — countershaft cluster gear, *15* — spacer, *16* — synchronizer hub, *17* — drain plug, *18* — transmission case, *20* — 2nd and 3rd speed synchronizer sleeve, *21* — roller bearing locking ring, *22* — ball bearing, *23* — clutch collar, *24* — drive gear shaft, *25* — reverse speed gear.

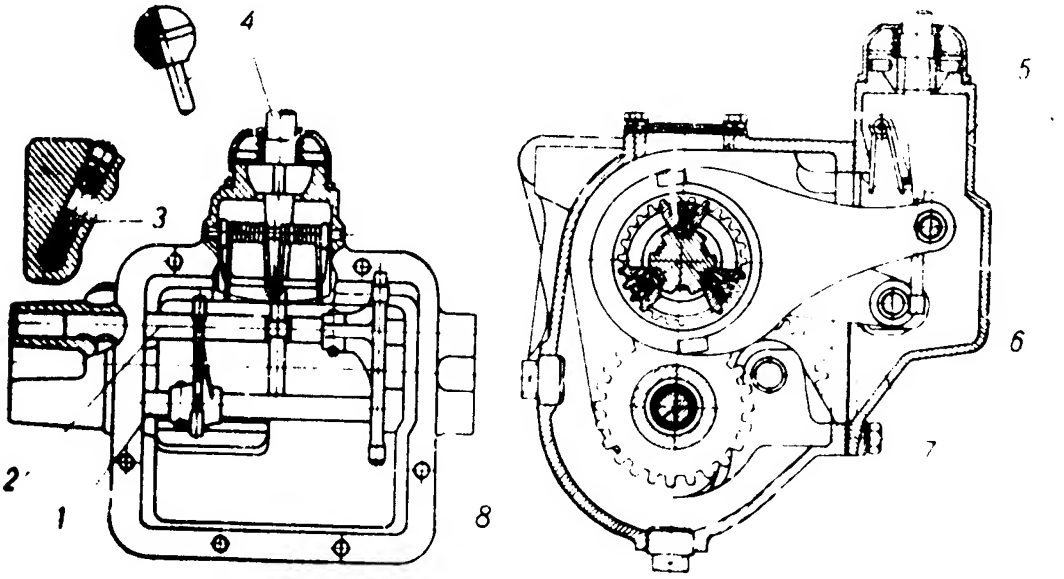


Fig. 24. Gear Shift Mechanism

1, 2 — gear shift shaft, *3* — lock, *4* — gear shift lever, *5* — gear shift mechanism cover, *6* — shift forks, *8* — case check plug

The care of the transmission consists in changing the oil every 6,000 km of operation, and seasonal replacement of oil (in spring and fall) as well as in regular checking of the oil level and topping up after 1,000 km of operation.

The oil level in the transmission housing should be at the lower edge of the control plug.

TRANSFER CASE (Fig. 25)

The transfer case serves to transmit engine torque to the rear and front axles and to increase traction of the wheels. The case has two low gears with 1.15 and 2.78 ratios. Control of the transfer case is by two levers. The left-hand lever disengages the front axle (forward position) and engages it (backward position). The right-hand lever is the gear shift lever having three positions: front — the 2.78 gear engaged, neutral — the transfer case inoperative, and rear — the 1.15 gear engaged. The low speed may be engaged only after stopping the automobile and engaging the front axle being intended for use only over extremely difficult roads.

The countershaft and the driven shaft of the transfer case are carried on tapered roller bearings. Bearing adjustment is accomplished by means of adjusting shims laid under the bearing caps.

The transfer case control system incorporates an interlock mechanism preventing the low gear to be engaged when the front axle is disengaged and the front axle to be disengaged with engaged low gear.

The care of the transfer case consists in regular lubrication, checking the attachment of the propeller shaft flanges and adjustment of shaft play.

PROPELLER SHAFTS

The automobile is equipped with three propeller shafts: intermediate — between the transmission and transfer case, front, and rear — between the transfer case and front and rear axles.

The propeller shafts are installed with splined ends directed towards the transfer case.

The care of the propeller shafts consists in regular lubrication of universal joints, splines, sliding yokes, cleaning the shafts from dirt and inspection of seals. If a splined connection is to be disassembled see that during reassembly the pointer marks are lined up.

REAR AXLE (Fig. 26)

The rear axle includes a split casing with axle shaft sleeves. The sleeves accommodate: the bevel main drive and differential with two bevel satellites and axle shaft gears. The axle shafts are inserted into the splined holes of the axle shaft gears.

The care of the rear axle consists in regular lubrication, tightening

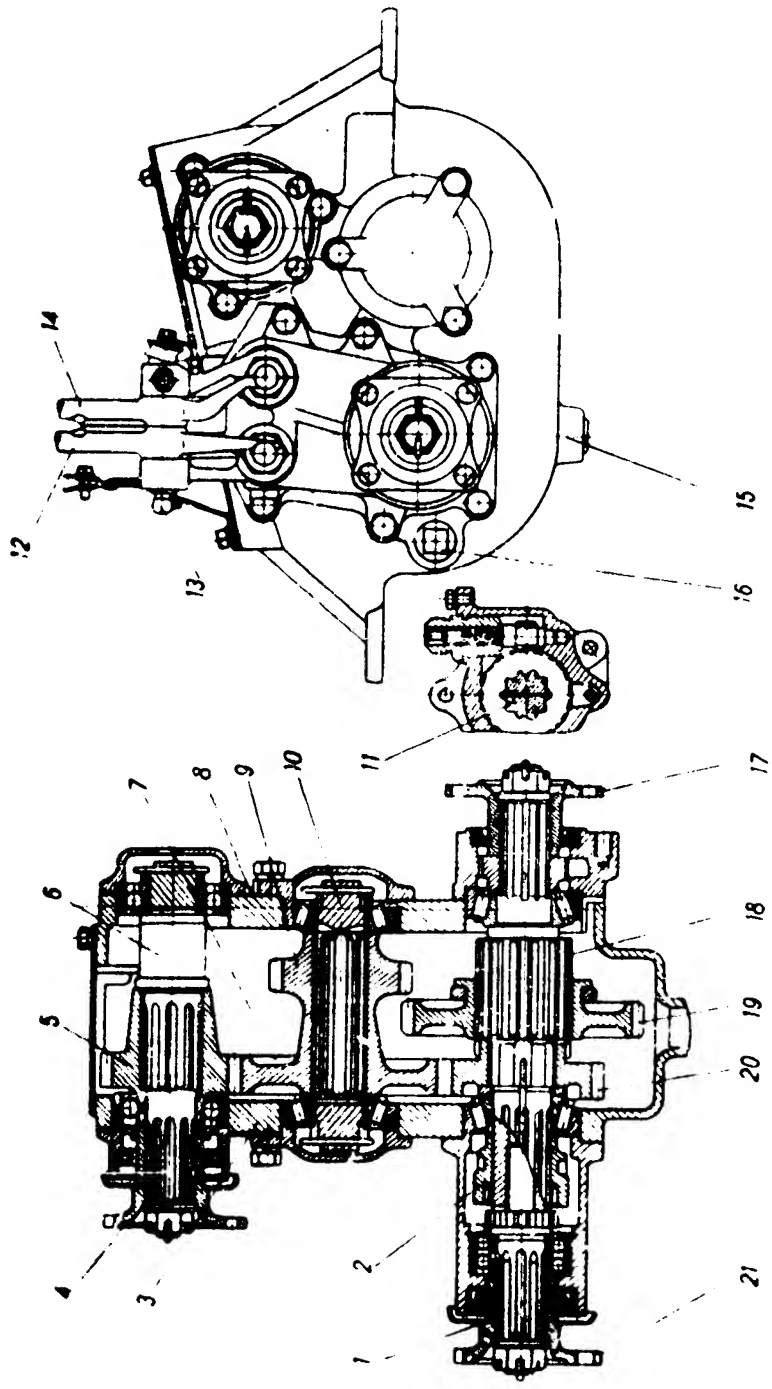


Fig. 25. Transfer Case

1 – front axle drive shaft, *2* – front axle engagement sleeve, *3* – casing, *4* – intermediate propeller shaft attachment flange, *5* – transfer case drive gear, *6* – drive shaft, *7* – idler gear, *8* – adjusting shims, *9* – low speed drive gear, *10* – counter-shaft, *11* – speedometer drive, *12* – transfer case control lever, *13* – oiler, *14* – front axle engaging lever, *15* – drain plug, *16* – filler plug, *17* – rear propeller shaft attachment flange, *18* – driven shaft, *19* – low speed sliding gear, *20* – driven gear, *21* – front propeller shaft attachment flange.

loose attachments, adjustment of bearings and adjustment of gear mesh (when replacing or repairing the main drive).

When lubricating the rear axle, add oil to the filler plug level and clean the breather air hole.

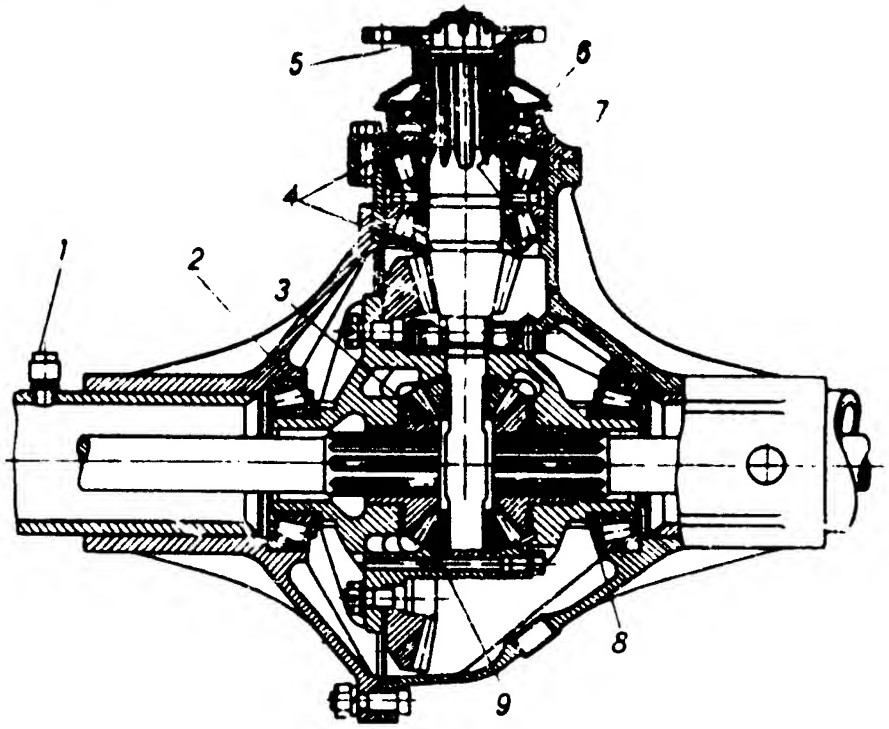


Fig. 26. Rear Axle

1 — breather, 2, 8 — differential bearing adjusting shims, 3 — axle shaft gear thrust washer, 4 — drive gear positioning shims, 5 — tail piece bearing nut, 6 — tail piece bearing adjusting shims, 7 — oil retainer ring, 9 — satellite thrust washer.

The tightening of the double tapered bearing of the end piece is adjusted by means of shims placed between the inner bearing races. The end piece should be free to rotate and have no axial play.

After adjustments check the bearings for heating during operation. If the bearing is heated considerably, increase the thickness of the adjusting shims.

The differential bearings are adjusted by changing the thickness of shims laid between the inner bearing races.

The adjustment of main drive bevel gear mesh is effected by changing the places of shims at outer races of the end piece bearing and at inner races of the differential bearings. The total thickness of shims in each pair of bearings should remain unchanged.

The side play of the gear teeth should be within 0.2 to 0.6 mm as measured on the drive gear end piece at a radius of 40 mm.

After adjustments check the bearings for heating in motion.

FRONT AXLE (Figs. 27 and 28)

The middle part of the front axle (main drive bevel gear and differential) is identical with the rear axle and is adjusted in a similar man-

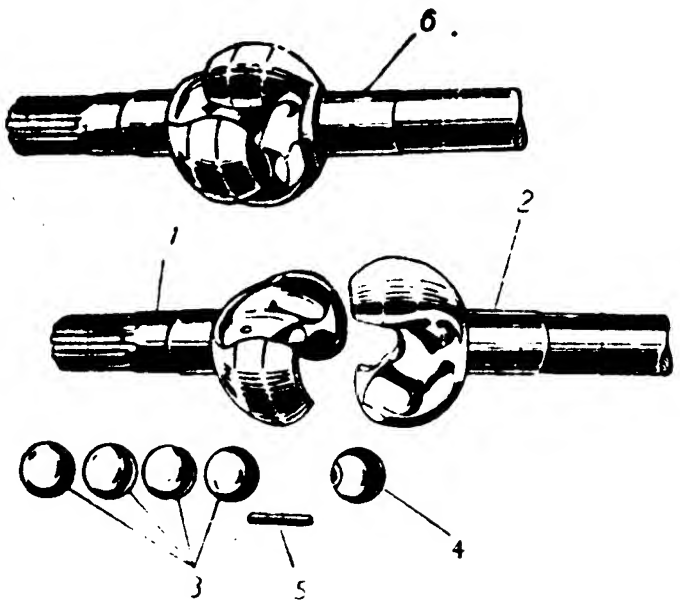


Fig. 27. Front Axle Shaft Joint

1 — driven knuckle, *2* — driving knuckle, *3* — driving balls, center ball, *5* — center ball pin, *6* — joint assembly.

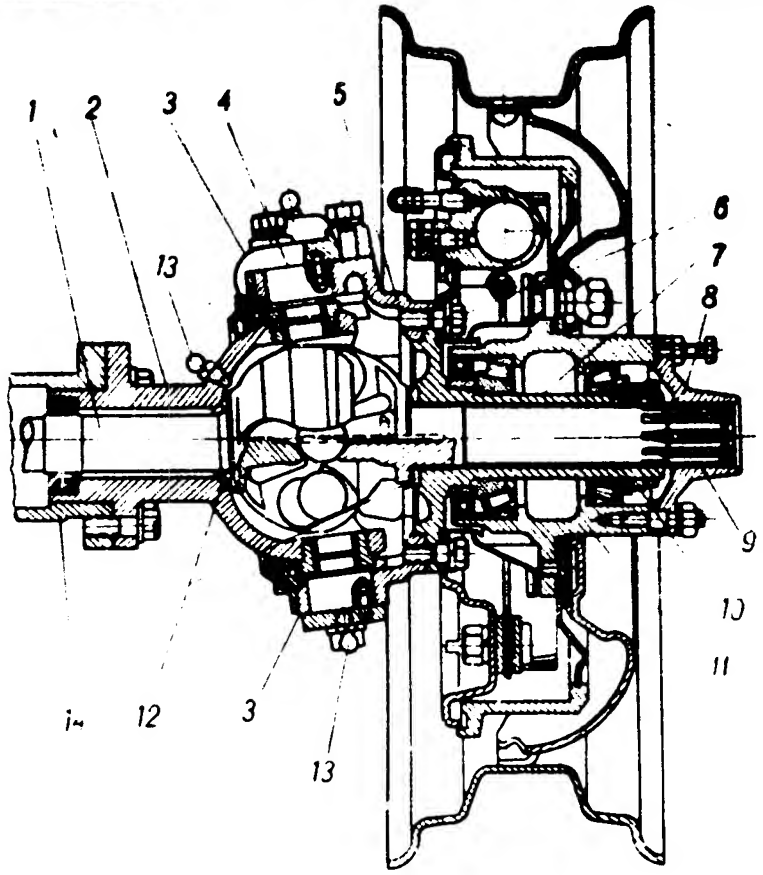


Fig. 28. Steering Knuckle and Front Wheel

1 — driving knuckle, *2* — ball support, *3* — king pin adjusting shims, *4* — king pin, *5* — steering knuckle body, *6* — steering knuckle journal to body attaching bolt, *7* — steering knuckle journal, *8* — hub flange, *9* — driven knuckle, *10* — hub bearing adjusting nut, *11* — wheel hub, *12* — joint thrust washers, *13* — oiler, *14* — axle shaft sleeve.

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ner. Since the front axle transmits tractive effort to the front wheels the outer ends of axle shafts are provided with pivots consisting of the driving and driven knuckles, a centering ball and four driving balls.

The ball support with pressed-in steering knuckle pivots is bolted to the axle shaft sleeve. The steering knuckle body is mounted on the ball support by means of two pivots. The trunnion and brake plate are attached to the steering knuckle body. Located inside the trunnion is the driven knuckle of the axle shaft connected by a flange with the wheel hub, rotating on the rtunnion in two tapered bearings.

The care of the front axle is similar to the care of the rear axle. In addition, it is necessary periodically to check and adjust the play of the pivot pins and regularly lubricate the pivot pins and pivots through speciai grease fittings.

The pivot pin play is adjusted by means of shims. To avoid interfering with alignment, always remove the same number of shims from top and bottom.

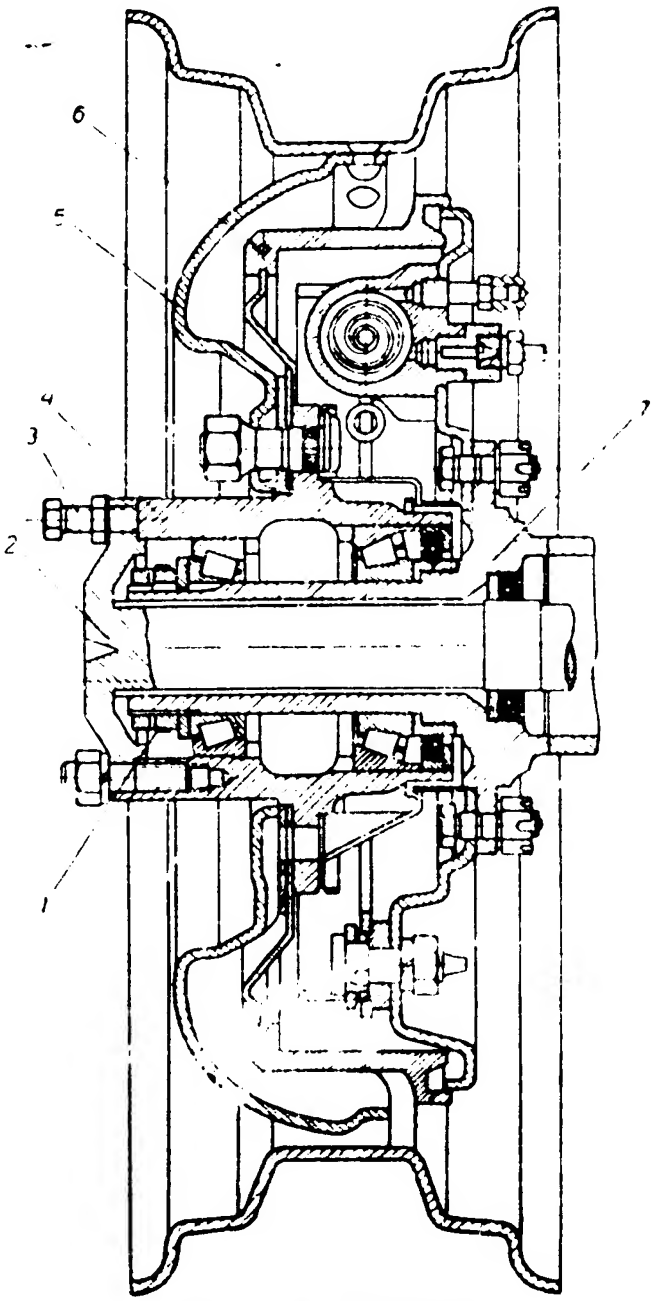


Fig. 29. Rear Wheel Hub

1 — Bearing adjusting nut, 2 — axle shaft flange, 3 — flange removing bolt, 4 — hub, 5 — wheel disc, 6 — brake drum, 7 — axle shaft sleeve.

WHEEL HUBS
(Figs. 28 and 29)

The hubs of the front and rear wheels rotate in two tapered roller bearings which require adjustment in operation for elimination of axial play.

Adjust the wheel bearings as follows:

1. Jack up the wheel.
2. Remove the hub flange.
3. Remove the lock nut and take off the lock washer.

4. Loosen the bearing adjusting nut.
5. Check ease of wheel rotation.
6. Tighten the wheel nut sufficiently to enable the wheel to be rotated by hand though not too easily.
7. Back off the nut 2 or 2 1/2 faces, replace the lock washer and lock nut.
8. Check bearing adjustment by feeling the heating of the wheel hub in motion.

RUNNING GEAR AND STEERING GEAR

STEERING GEAR (Fig. 30)

The steering gear comprises the worm mechanism and steering rods. The care of the steering gear consists in lubricating the steering mechanism and rod joints, checking their attachments, adjusting the steering gear for mesh and backlash.

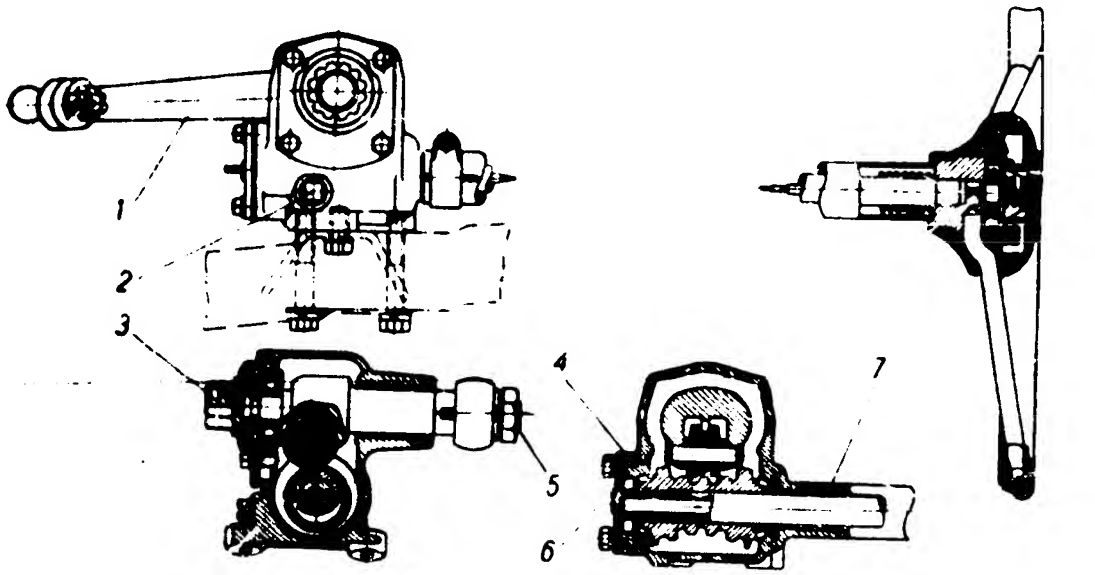


Fig. 30. Steering Gear

1 — Steering arm, 2 — filler plug, 3 — mesh clearance adjusting screw, 4 — worm bearing adjusting shims 5 — steering arm shaft, 6 — front cover, 7 — steering shaft.

With a properly adjusted steering mechanism the steering wheel should have no backlash when the automobile is driven straight ahead. When the steering wheel is turned to any extreme position the backlash reaches 30°. If in the straight ahead position the backlash exceeds 40 mm along the steering wheel rim it is necessary to adjust clearance of the steering couple displacing axially the steering arm shaft by means of the adjusting screw located on the upper cover of the steering gear case. Before making any adjustments inspect steering case attachments and condition of joints.

Worn worm bearings are adjusted by reducing the number of shims

laid under the front cover of the steering gear case. For making adjustments the steering gear should be removed from the automobile.

Tightening of bearings is checked with the removed steering arm shaft. The effort necessary for rotating the steering wheel, applied to the wheel rim should be 0.22 to 0.45 kg. In the assembled mechanism this effort should be 0.7 to 1.2 kg.

BRAKES (Figs. 31, 32 and 33)

The automobile is equipped with independent foot and hand brake systems. The foot or service brake has a hydraulic drive and is applied to all four wheels. The hand or parking brake is operated mechanically and is applied to the power transmission.

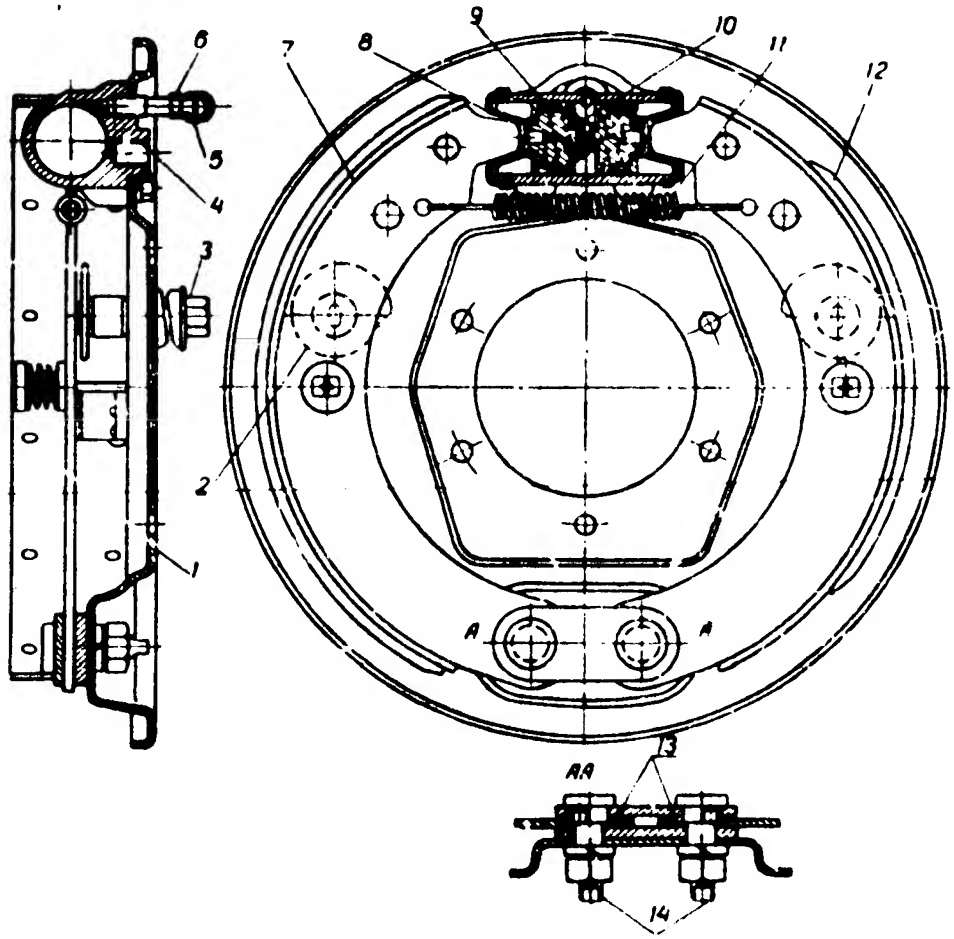


Fig. 31. Wheel Brake

1 — Brake shield, 2 — adjusting eccentric, 3 — eccentric head, 4 — wheel cylinder, 5 — cap, 6 — bleeder valve, 7 — front shoe, 8 — housing, 9 — piston, 10 — spring, 11 — pull back spring, 12 — rear shoe, 13 — locating eccentric, 14 — pins.

The care of the brakes consists in adjusting the brake shoe clearance, the play of the brake pedal, the length of the hand brake cable and in regular filling the hydraulic system with brake fluid.

As the brake shoe linings become gradually worn the shoe to drum clearances are increased. With correct clearances full braking should take place during the first half of the brake pedal travel. The brakes are adjusted by means of two eccentrics whose hexahedral ends project outside.

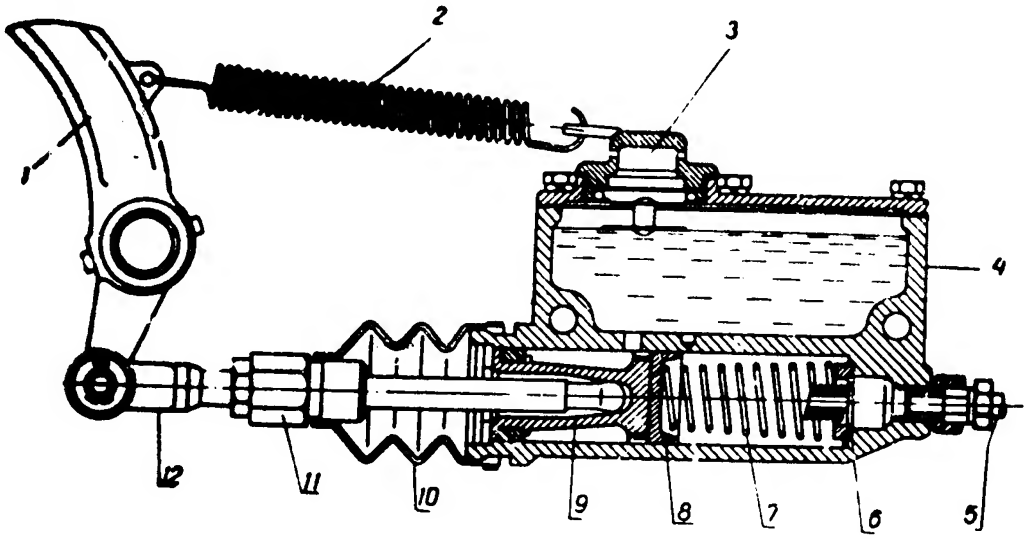


Fig. 32. Brake Master Cylinder

1 — brake pedal, *2* — pedal spring, *3* — filler plug, *4* — body, *5* — brake line, *6* — valves, *7* — plunger spring, *8* — collar, *9* — plunger, *10* — housing, *11* — pusher, *12* — pedal yoke.

To adjust the brakes:

1. Jack up the wheel.
2. Rotating the wheel turn the adjusting eccentric of the front brake shoe until the shoe brakes the wheel.
3. Loosen the eccentric gradually until the wheel is free to rotate again.
4. Adjust the rear brake shoe in the same way.
5. Adjust the brakes of the remaining wheels.
6. Check the brake drums for heating while the automobile is in motion.

Do not check brake adjustment by turning the brake shoe supporting pins. These pins have to be adjusted during replacement of brakes or linings only.

The play of the brake pedal is determined by the clearance between the pusher and the piston of the brake master cylinder. The clearance should be 1.5 to 2.5 mm which corresponds to a brake pedal play of 11 to 14 mm. The adjustment is carried out by changing the length of the pusher which is done by screwing it on the pedal fork (See Fig. 32).

The hydraulic brake system is filled with 0.4 liters of special brake fluid.

Fill the system as follows:

1. Remove the floor mat and the access hole cover, unscrew the filler plug of the brake master cylinder and fill it with fluid.

2. Remove the cap from the bleeder valve on the rear right wheel cylinder and slip a rubber hose 350 to 400 mm long on the valve. Dip the other end of the hose into a glass container of 1 liter capacity, half-full of brake fluid.

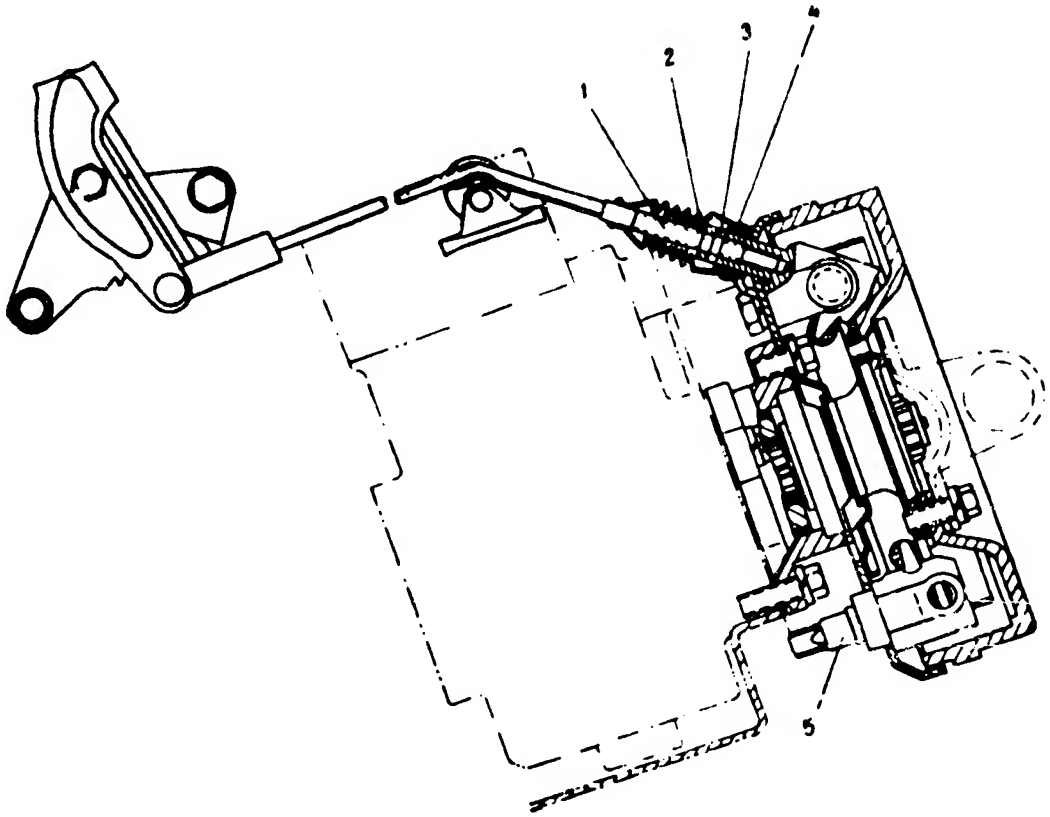


Fig. 33. Hand Brake Linkage

1 — cable end, *2* — lock nut, *3* — nut, *4* — brake shoe expander rod, *5* — adjusting screw.

3. Loosen the bleeder valve 1/2 or 3/4 of a turn and pump the brake pedal a few times, depressing it sharply and slowly releasing it. This will make the fluid fill the pipes and expel air out of them. Bleed the system until the air bubbles cease to emerge from the hose dipped in the container with fluid. While bleeding the system add fluid in the brake master cylinder.

4. Screw in the wheel cylinder bleeder valve tightly and replace the cap. Turn the valve IN with depressed brake pedal.

5. The brakes should be bled in the following sequence: rear right, front right, front left and rear left.

6. After bleeding fill the brake master cylinder 15 or 20 mm below the upper edge of the hole and screw in the plug tightly.

With correct shoe to drum clearances and absence of air in the system the depressed brake pedal should go down not farther than half of its travel after which the foot should feel a resistance. If the pedal

moves lower it is an evidence of excessive clearances. If no resistance is felt it shows that the system is air-bound.

Efficient functioning of the hand brake is ensured by correct setting of the brake shoe springs. The stronger springs painted black should be installed on the right-hand side. The weaker springs painted red should be installed on the left-hand side.

The hand brake needs adjustment when the lever travel is insufficient for the full braking which is caused by excessive clearances between the brake shoes and drum or by excessive length of the brake cable.

To adjust the shoe to drum clearance turn the adjusting screw all the way IN then back it OFF 4 to 6 clicks (1/3 or 1/2 of a turn).

To adjust the length of the brake cable move the lever handle into the third tooth space of the segment gear (counting from the rear end). Then unscrew the lock nut and nut of the cable and screw the cable end piece IN until braking begins. Lock the cable in this position.

SUSPENSION (Fig. 34)

The automobile suspension consists of four semi-elliptic springs and four hydraulic shock absorbers.

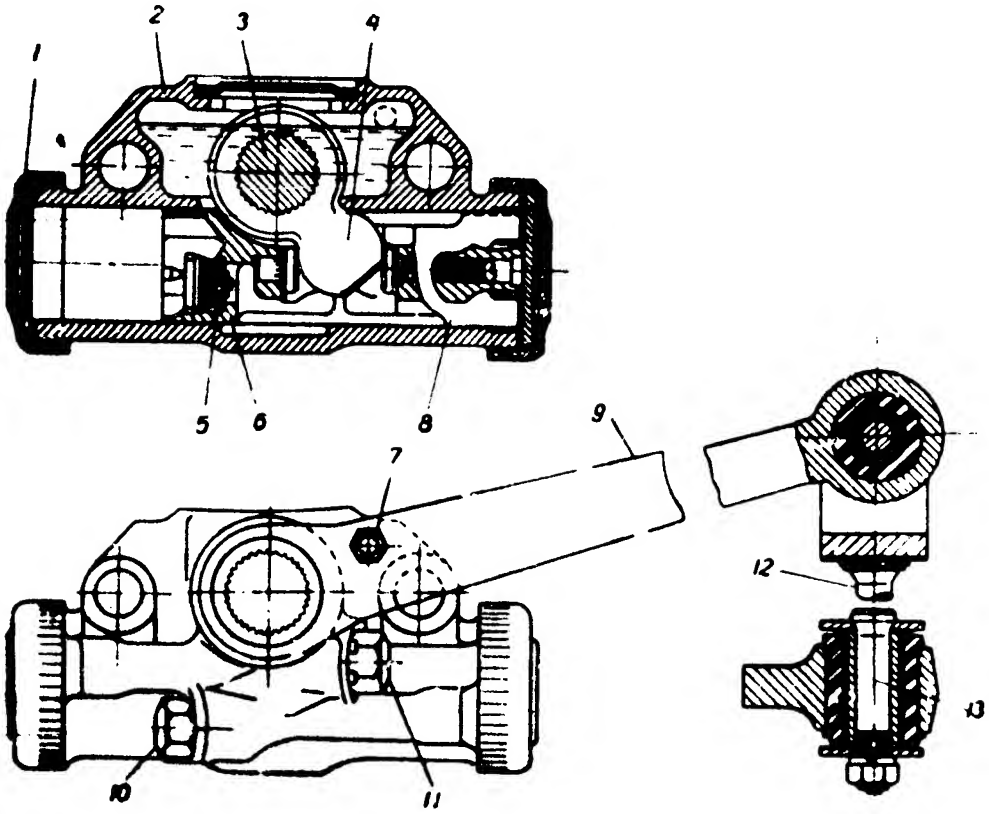


Fig. 34. Shock Absorber

1 – Shock absorber cylinder cover, 2 – shock absorber body, 3 – shock absorber shaft, 4 – cam, 5 – inlet valve, 6, 8 – shock absorber pistons, 7 – filler plug, 9 – shock absorber lever, 10 – compression stroke valve plug, 11 – return stroke valve plug, 12 – shock absorber bracket, 13 – bracket attachment

Placed between the springs the leaves are gaskets of plywood soaked in mineral oil. The springs are attached by spring bolts with rubber sleeves.

Two way piston type shock absorbers are installed on all wheels.

The care of the suspension consists in regular cleaning, inspection of attachments, periodical lubrication and adding fluid to the shock absorbers.

When topping up the shock absorbers without removing them from the automobile disconnect the shock absorber bracket, and add fluid by small portions, rocking the lever.

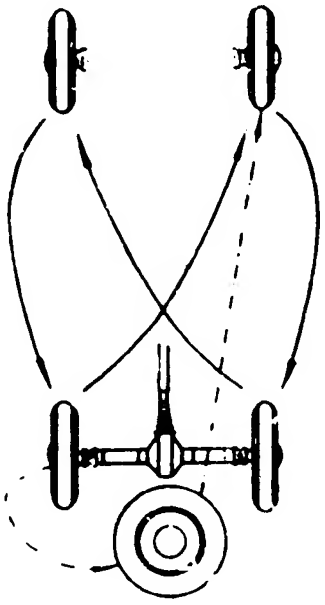


Fig. 35. Tyre Interchanging Sequence

TYRES

The automobile is equipped with low pressure tyres 6.50 × 16". The care of the tyres consists in the following:

Daily, before work check tyre pressures (2 kg/sq. cm for front wheels, 2.2 kg/sq. cm for rear wheels). Check condition of tyre valves and presence of valve caps.

After work inspect the tyres, remove foreign articles from them. Keep oil and gasline away from the tyres.

If the automobile is to stand idle for more than 10 days, the tyres should be relieved by jacking the automobile and placing it on trestles. Do not allow the automobile to stand on deflated tyres.

Removed tyres should be stored in a dry place at a maximum temperature of +20° C and a relative air humidity of 50 to 80 per cent. Store the tyres in a vertical position on wooden racks and the tubes — slightly inflated on hangers with a half-rounded shelf. From time to time the tyres and tubes should be turned over.

During operation check frequently the tyre pressure. Incorrect pressure renders engagement and disengagement of the front axle difficult, causes overheating of the transfer case and results in premature wear of the tyres.

Avoid rough braking and knocking against curbs as this causes excessive wear of the tyres. During stops inspect the tyres and remove stuck nails and similar articles.

To ensure uniform wear of the tyres interchange them every 3,000 km, as shown in Fig. 35. If the tyres wear irregularly, adjust the toe-in by changing the length of the steering tie rod. The toe-in should be within 1.5 to 3.0 mm.

The tyres should be mounted as follows:

1. Prior to mounting check condition and cleanliness of the wheel rim.

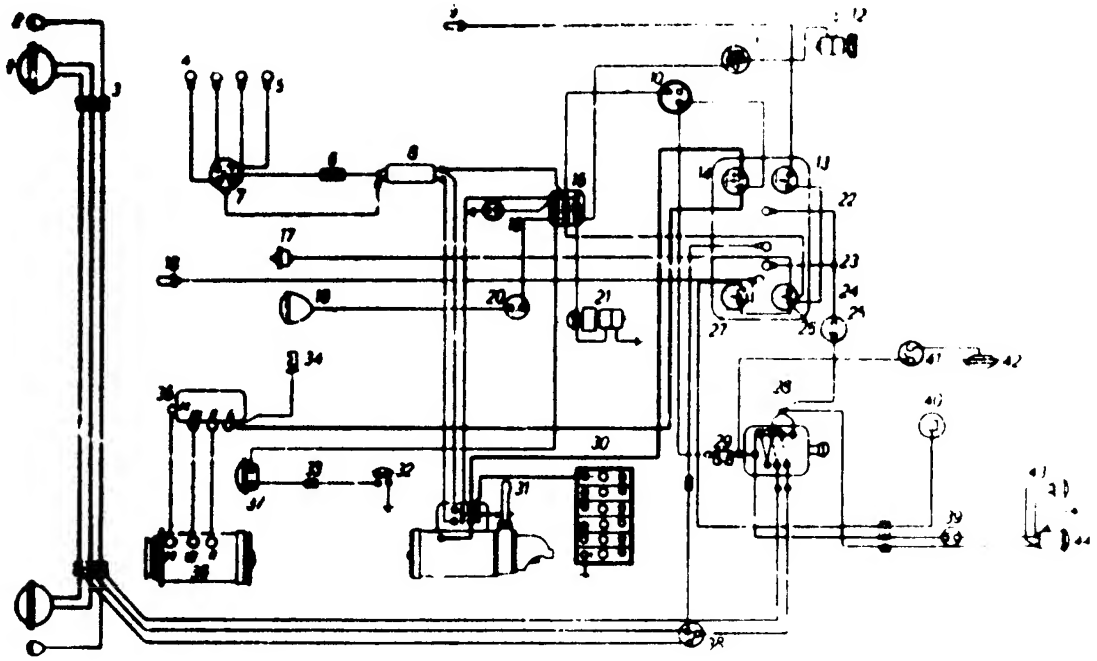


Fig. 36. Wiring Diagram

1 — head lamp, *2* — side lamp, *3* — connection panel, *4* — spark plugs, *5* — suppressor resistor, *6* — suppressor resistor, *7* — distributor, *8* — ignition coil, *9* — thermometer unit, *10* — ignition switch, *11* — fan switch, *12* — defroster ventilator, *13* — thermometer, *14* — ammeter, *15* — fuse block, *16* — socket, *17* — pressure gauge unit, *18* — tell-tale lamp unit, *19* — spotlight lamp, *20* — switch, *21* — windscreen wiper, *22* — country light indicator lamp, *23* — instrument panel lamps, *24* — water temperature tell-tale lamp, *25* — switch, *26* — pressure gauge, *27* — gasoline level indicator, *28* — lighting master switch, *29* — button fuse, *30* — storage battery, *31* — starting motor, *32* — horn button, *33* — connecting sleeve, *34* — hood lamp, *35* — current and voltage regulator, *36* — generator, *37* — horn, *38* — lighting foot switch, *39* — stop light switch, *40* — fuel tank rheostat, *41* — switch, *42* — lighting lamp in cab, *43* — tail light, *44* — trailer socket.

2. Powder the tyre and tube with talc.

3. Install the tyres in accordance with the arrows pointing in the direction of rotation.

4. See that the tube valve is properly installed in the rim, without deformation. Before inserting the second tyre bead into the rim inflate the tube enough to make it unfold.

5. Put caps on tyre valves to protect valve cores from dirt.

ELECTRIC EQUIPMENT

The electric equipment comprises the generator with current and voltage regulator, storage battery, lighting system, starting motor and instruments.

The general wiring diagram is shown in Fig. 36.

GENERATOR

The generator is a shunt-wound two-brush machine driven by the fan belt. Service the generator as follows:

DIRECTION INDICATORS

The side lamps serve as the front direction indicators. For this the two filament bulbs (21×6 c. p.) are located in side lamps.

There are two special tail lamps with the same two filament bulbs (filament 21 c. p. is connected the direction indicators system). Direction indicators have only one (red) tell-tale lamp 1 c. p. located on the instrument panel which is lighted up when the direction indicators system is switched on.

The direction of turning is defined by position of the lever switch installed above the lever switch to the left: right position—right turn, left position—left turn.

Direction indicators breaker PC-55 is installed beside the fuse block.

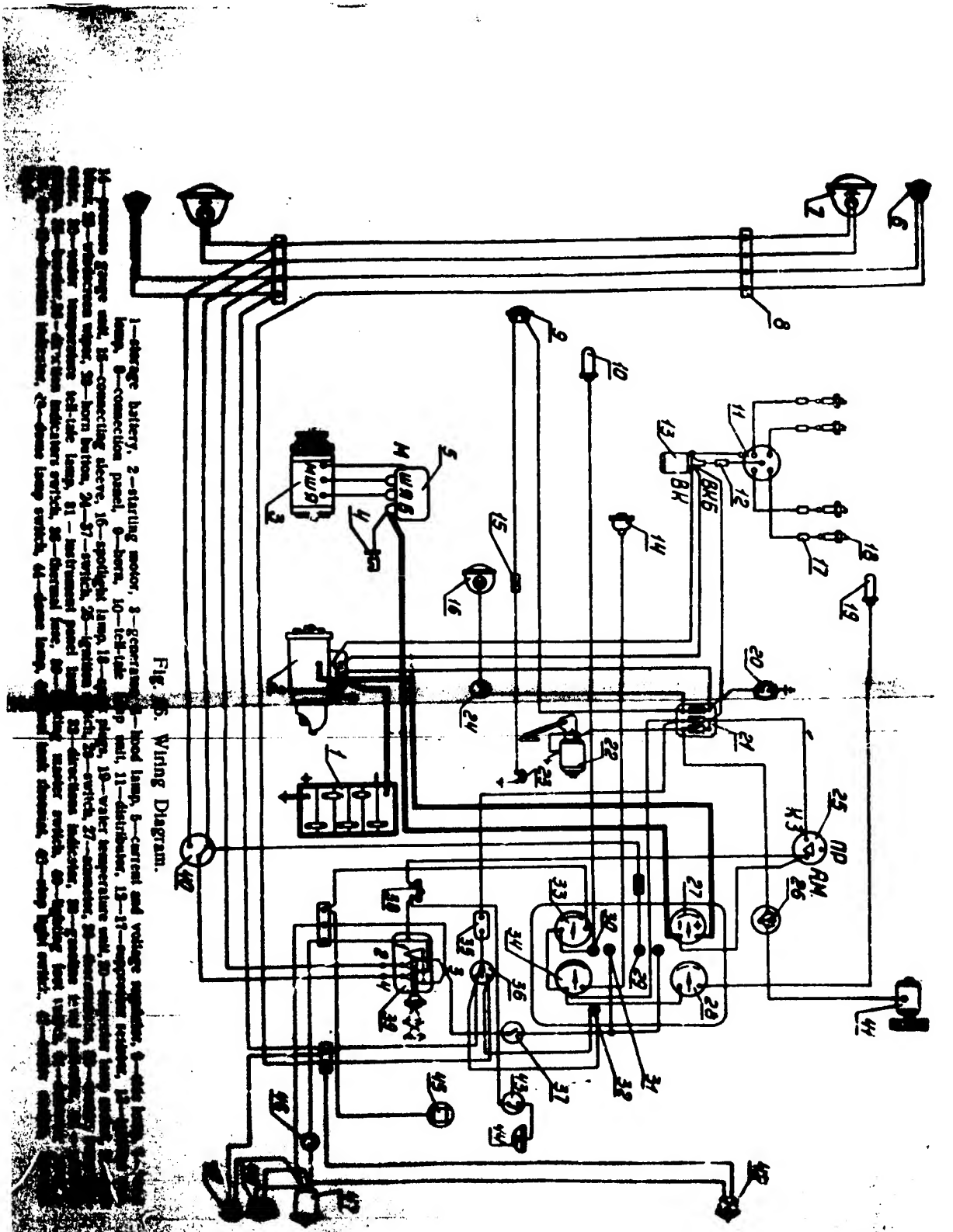


Fig. 46. Wiring Diagram.

1—storage battery, 2—starting motor, 3—generator, 4—hood lamp, 5—current and voltage regulator, 6—side lamp, 7—connection panel, 8—horn, 10—left-side lamp, 11—distributor, 12—ignition resistor, 13—rear lamp, 14—pressure gauge unit, 15—connecting sleeve, 16—spotlight lamp, 17—[illegible] plug, 18—water temperature unit, 19—inspection lamp, 20—windscreen wiper, 23—horn button, 24—27—switch, 28—ignition switch, 29—direction indicator, 30—rear-side lamp, 31—instrument panel lamp, 32—water temperature indicator, 33—fuel gauge unit, 34—direction indicators switch, 35—thermal fuse, 36—master switch, 40—heating fan switch, 41—fuse, 42—direction indicator, 43—dome lamp, 44—dome lamp switch, 45—heating light switch, 46—[illegible]

Every 1,000 km check the attachment of the generator and generator pulley and inspect all contact connections.

Every 6,000 km do the following:

1. Inspect generator brushes, check their contact with the commutator, check brush pressure (1,250 to 1,750 g). Replace the brushes if the pressure is less than 800 g.
2. Blow out the commutators with compressed air and wipe with a cloth soaked in gasoline.
3. Should the commutator become badly worn clean it with fine emery paper.

Lubricate the generator bearings as described in the Lubrication Chart.

CURRENT AND VOLTAGE REGULATOR

The current and voltage regulator type PP-20 is installed under the engine hood being closed by a hermetic cap and sealed. The current and voltage regulator consists of the circuit breaker, current limiting regulator and voltage regulator (Fig. 37).

Every 6,000 km check the regulator adjustment and clean its contacts.

The circuit breaker is checked as follows (Fig. 38):

1. Disconnect the cable from the »Б» terminal of the current and voltage regulator and cut in a check ammeter between this cable and the »Б» terminal.
2. Cut in a check voltmeter between the »Я» terminal and ground.
3. Start the engine, increase its speed and mark the voltage at which the circuit breaker contacts close (closing of contacts is determined by the deviation of the ammeter pointer). This voltage should be 12.2 to 13.2 V.
4. When decreasing engine speed determine by the ammeter the return current at which the circuit breaker contacts open. The current should be 0.5 to 6.5 A.

The current limiting regulator should be checked as follows:

1. Jack up both automobile axles. Engage the front axle.
2. Cut in a check ammeter as shown in Fig. 38.
3. Switch on the starting motor a few times in order to slightly discharge the storage battery.
4. Start the engine and smoothly engage the high gear. Depress the accelerator pedal until the speedometer reads 41 to 46 km/hr which corresponds to 1,800—2,000 r.p.m. of the engine.
5. Switch on all the current consumers on the automobile. The check ammeter should register 17 to 19 A. In 1 1/2 or 2 min the battery will be charged and the charging current will be less than 10 A.

The voltage regulator must be checked as follows:

1. Jack up both axles and engage the front axle.
2. Cut in a check voltmeter between the »Б» terminal and ground.
3. Cut in a check ammeter between the »Б» terminal and black cable leading from the ammeter installed on the instrument panel.

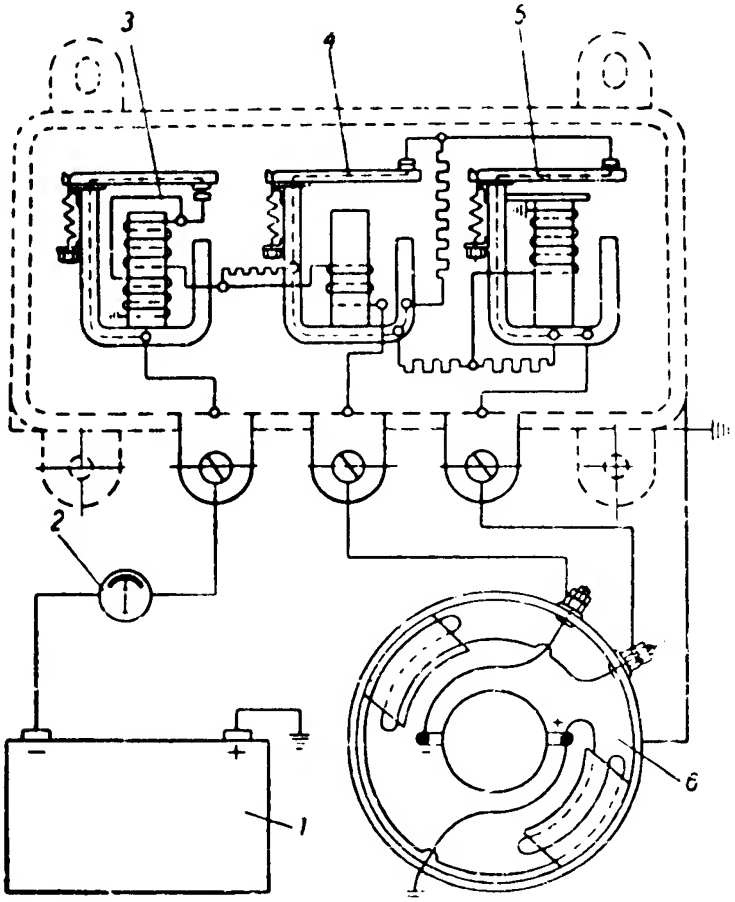


Fig. 37. Current and Voltage Regulator and Generator Hook-Up

1 — storage battery, 2 — ammeter, 3 — circuit breaker, 4 — current limiting regulator, 5 — voltage regulator, 6 — generator.

4. Increase engine RPM until the speedometer reads 41 to 46 km/hr. If with the fully charged battery the check voltmeter registers more than 15.5 V this is an evidence that the current and voltage regulator is out of order.

5. Disconnect the storage battery with the engine running.

6. Switch on the current consumers so that the generator load is 10 A as shown by the check ammeter. The voltage registered by the voltmeter after 10 minutes' operation should be 14.2 to 14.8 V.

After 24,000 km of operation remove the current and valtage regulator from the automobile, open it, inspect and tighten all terminals. Inspect and clean the contacts with a special abrasive plate and wipe with paper.

Check the armature to core clearances on the voltage regulator and current limiting regulator (Fig. 39). The clearance should be 1.4 to

1.5 mm with closed contacts. Check the clearance as shown in Fig. 39. To adjust the clearance loosen the screws and move the contact bracket.

Subsequent to cleaning the contacts and adjusting the clearance check functioning of the voltage regulator. To increase generator voltage increase armature spring tension by tightening the adjusting nut.

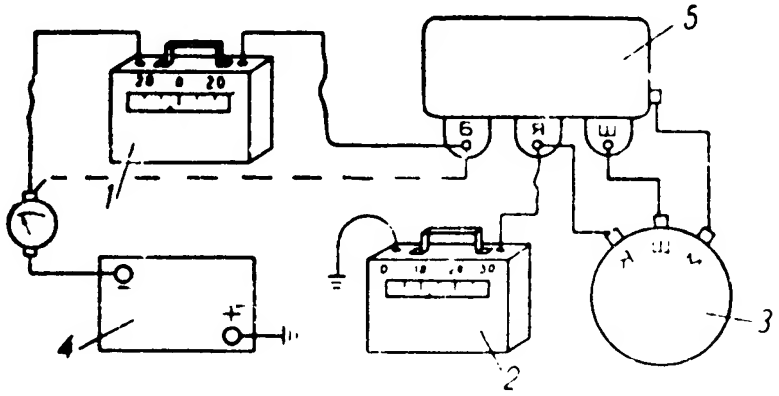


Fig. 38. Current and Voltage Regulator Checking Diagram

1 – ammeter, *2* – voltmeter, *3* – generator, *4* – storage battery, *5* – current and voltage regulator

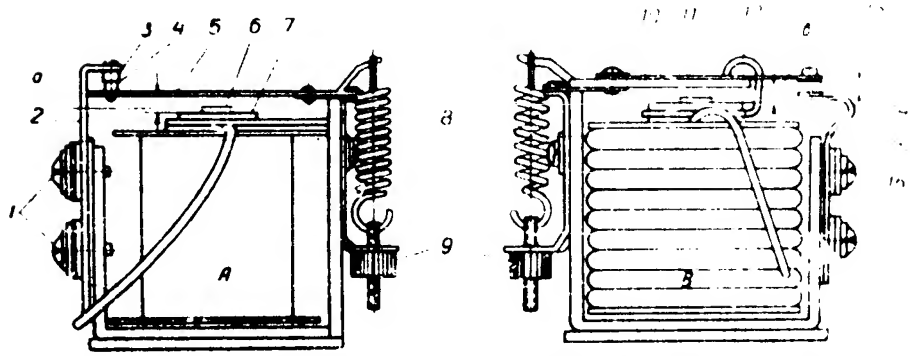


Fig. 39. Checking PP2O Current and Voltage Regulator Clearances

A – in voltage regulator and current limiting regulator, *B* – in circuit breaker.
1 – contact bracket attachment screws, *2* – contact braket, *3* – fixed contact, *4* – moving contact, *5* – armature, *6* – brass dowel, *7* – core, *8* – armature spring, *9* – adjusting nut, *10* – armature, *11* – current carrying plate, *12* – shackle, *13* – moving contact, *14* – fixed contact, *15* – contact bracket, *16* – contact bracket attachment screws;
a – armature to core clearance in voltage regulator and current limiting regulator; *b* – armature to core clearance in circuit breaker; *c* – circuit breaker contact clearance.

The clearances of the current limiting regulator are checked and adjusted in the same manner as in the voltage regulator. To increase current — increase spring tension.

In the circuit breaker the armature to core clearance should be 1.3 to 1.5 mm with opened contacts. The clearance between contacts should be 0.7 to 0.9 mm. Adjustment of the armature to core clea-

rance is done by bending the armature limiting shackle. The contact clearance adjustment is done by bending the contact bracket. To increase voltage at which the contacts close increase spring tension.

STORAGE BATTERY

The automobile is equipped with the 6CT-54 storage battery, 12 V, 54 A-h at 10 hour discharging rate. The specific gravity of the electrolyte in the fully charged battery in temperate climate should be 1.285 in winter and 1.270 in summer. At a temperature below −35 C the specific gravity should be increased up to 1.310. In the south regions in summer bring the specific gravity down to 1.240.

Avoid discharging the battery in excess of 50 per cent in summer and 25 per cent in winter. The electrolyte specific gravity in relation to the degree of battery charging is given in the Table. The specific gravity should be tested by a special hydrometer taking into account temperature corrections.

SPECIFIC GRAVITY OF ELECTROLYTE AT 15 C

Full charge	25 % discharge	50 % discharge
1.310	1.270	1.230
1.285	1.245	1.205
1.270	1.230	1.190
1.240	1.200	1.160

It should be noted that in cold weather the storage battery capacity is reduced by 1 or 2 per cent with each degree of temperature reduction.

As a rule the electrolyte level in the battery should be 10 to 15 mm above the screen protecting cell plates. The level is checked by means of a glass tube with an inside diameter of 3 or 5 mm. Insert the tube into the filler opening until it touches on the screen, close the top hole with the thumb and remove the tube. The height of the electrolyte in the tube corresponds to the height of the electrolyte above the screen. Add distilled water if necessary.

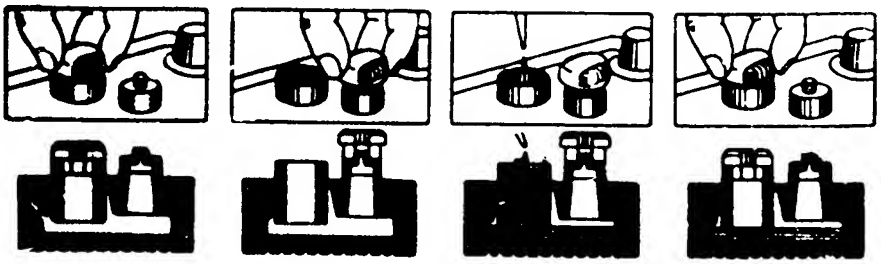


Fig. 40. Sequence of Storage Battery Refilling Operations

Add water in the sequence shown in Fig. 40. Unscrew the filler plug and slip it tightly over the ventilation hole tapered tip located near the filler hole. Add water almost up to the rim of the filler hole. Remove the plug from the ventilation hole and slip it in the filler hole. The electrolyte level will then drop to normal height.

To check the storage battery and determine the state of its charge — check the specific gravity of the electrolyte. In addition, every month check each cell with a resistance fork. When checking the battery with a resistance fork fitted with a resistor corresponding to 150 A the voltage of each cell of a charged battery should be not less than 1.5 V at least during 5 sec.

The care of the battery consists in regular inspections, cleaning, charging and maintaining proper level and specific gravity of the electrolyte.

Daily servicing:

1. Clean the battery from dirt. Wipe off spilled electrolyte. Clean corroded terminals and cable ends coat them with vaseline.
2. Check condition of battery attachments.
3. See that the cable terminals are tight.
4. Clear battery air vents.

After 1,000 km but not rarer than every 10—15 days in winter and 5—6 days in summer, do the following:

1. See that the electrolyte level is at the proper height. Add distilled water, if necessary.
2. Check the specific gravity of the battery solution for state of charge.
3. See that the terminals are tight and the battery case is in good condition.

HEAD LAMPS

The head lamps are equipped with a semi-sealed opical unit incorporating a steel reflector, lens, and a two-filament bulb with socket and cap. The lower 50 c.p. filament located in the reflector focus is used for the country light; the upper 21 c.p. filament is for traffic light.

The lens is held in place by bent reflector tongues. To replace a broken lens:

1. Unbend the reflector tongues, remove the damaged lens and rubber gasket.
2. Straighten up the reflector tongues and put in place the rubber gasket.
3. Install a new lens and bend the tongues.

To adjust the head lamp beams:

1. Place the unloaded vehicle on a level floor, squarely facing an adjusting screen 7.5 m from the head lamps and remove head lamp rims.
2. Turn the light on and see that the connections are correct and both head lamps flash on simultaneously.

3. Turn on the country light, cover one head lamp and adjust the other one by means of adjusting screws so that the hot spot on the screen is at a height of 725 mm from ground and 490 mm from the automobile center line.

4. Repeat the adjustment for the other lamp so as to position the upper limits of both hot spots on the same height.

The spotlight lamp installed to the left of the windscreen serves for additional lighting of the road. The switch for this lamp is located under the light socket to the left of, and below, the instrument panel.

The spotlight lamp can be turned by the driver's hand through an opening in the canopy side flap.

STARTING MOTOR Fig. 41

The four-pole, four-brush type CT20 starting motor with series excitation is used. The starter pinion is engaged automatically by the overrunning clutch.

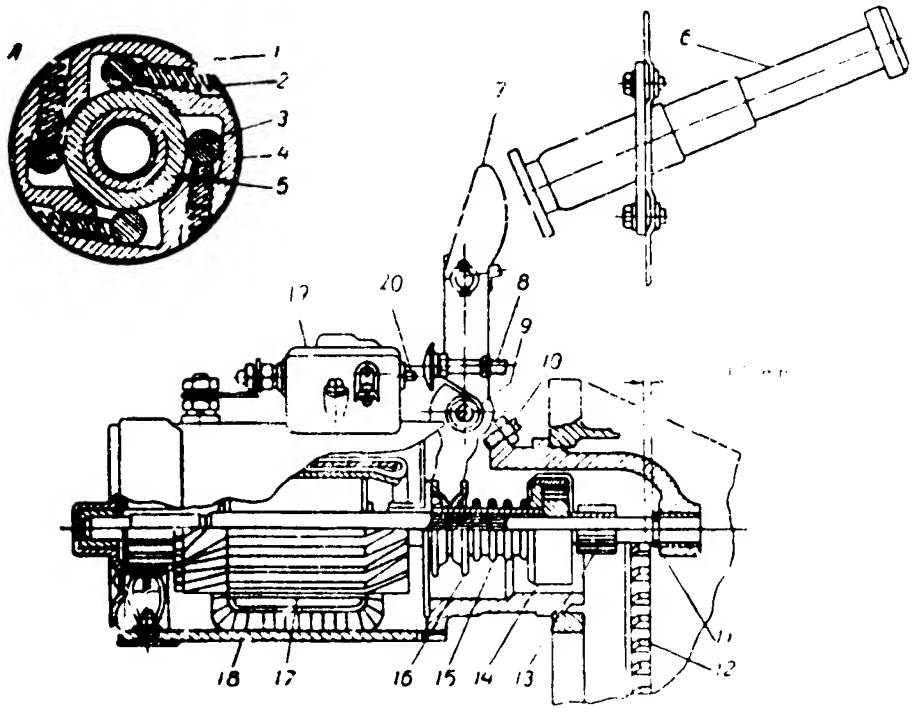


Fig. 41. Starting Motor and Engagement Mechanism

1 — outer case, *2* — spring, *3* — roller, *4* — sleeve body, *5* — inner case, *6* — pedal, *7* — engagement lever, *8* — adjusting rod, *9* — spring, *10* — adjusting screw, *11* — thrust washer, *12* — flywheel ring gear, *13* — starting motor pinion, *14* — overrunning clutch, *15* — spring, *16* — bushing, *17* — starting motor armature, *18* — starting motor body, *19* — switch, *20* — rod, *A* — overrunning clutch.

The drive clutch should be adjusted with the starting motor removed from the engine.

1. The clearance between the starter pinion and thrust washer in the extreme engaged position should be from 0.5 to 1.5 mm. The clearance may be adjusted by the special adjusting screw.

2. The contacts of the electric starter switch should start to close when the starter pinion has moved away from the thrust washer no more than 4 mm which is ensured by turning the adjusting rod OUT. After the contacts of the starter switch have closed the rod (20) should have an additional 1 mm travel.

3. The contacts cutting in the additional resistor of the ignition coil should close either simultaneously with the electric starter switch or somewhat earlier.

The care of the starting motor consists in checking its connections and cables every 1,000 km. After 12,000 km the starting motor should be removed and blown out with compressed air. Inspect condition of the commutator and brushes. Brush spring tension should be 850 to 1,400 g.

Care of the instruments:

1. When removing the remote water thermometer and oil pressure gauge units as well as the gasoline level gauge rheostat insulate the cable ends to avoid short-circuiting. When installing the oil pressure gauge unit see that the »Верх» (Top) mark is facing upwards.

2. See that the cooling water level does not drop too low as this may cause damage to the water temperature gauge unit due to overheating.

3. Once a year check the readings of the water temperature gauge by removing the unit and dipping it into hot water whose temperature is measured by a reference thermometer.

4. Once a year check the readings of the oil pressure gauge by means of a reference pressure gauge.

SPEEDOMETER AND FLEXIBLE SHAFT

The speedometer drive shaft is lubricated by a wick soaked with vaseline oil and placed in the hole in the speedometer tail piece. The hole is covered with a stamped brass plug. Every 25,000 km remove the speedometer, take out the plug and soak the wick with vaseline oil.

Every 25,000 km or earlier if the automobile is operated in hot climate, add vaseline oil to the flexible shaft sheath. In winter vaseline oil should be replaced by spindle oil. Pack lubricant into the sheath by an ordinary grease gun.

BODY

The ГАЗ-69 automobile is equipped with an all-metal open type two-door body with folding tailboard and removable canopy. The front seats are cushioned with collapsible backrests. Threeman seats located along the boards have semi-cushioned seats and backrests.

For transportation of goods the side seats are raised and secured by straps.

The automobile is equipped with a canvas canopy fixed on a dismountable metal frame. The doors are covered with removable side flaps. The frame, canopy and side flaps are stored inside the body so as not to block useful space: the two frame bows are so placed as to from side rails; the bow connecting members are secured under the side seats, the folded canopy is stored under the driver's seat and the side flaps are placed between the double walls of the tailboard.

Tool boxes are situated under the rear seats. The starting heater torch is secured in the left front tool box. The reserve oil can is located in the right front tool box. The rear boxes are empty.

The ГАЗ-69А automobile is equipped with an all-metal, open type, four-door body. The rear part of the body is provided with a luggage compartment.

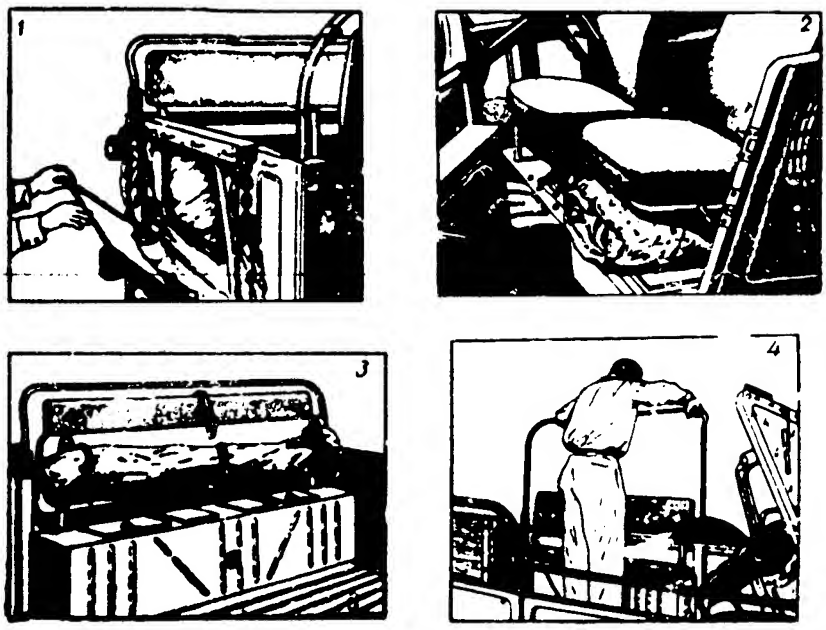


Fig. 42. Folding ГАЗ-69 Automobile Canopy

1 — placing side flaps between double walls of tail board, *2* — placing folded canopy under front left seat, *3* — placing bow braces, *4* — conversion of bows into rails.

The convas canopy is fixed on a dismountable frame. Both the canopy and frame are stored in the luggage compartment behind the rear seat. To fold the canopy remove two bolts attaching the canopy to the windscreen then disengage the two frame posts by depressing the dowel (Fig. 43) after which the canopy can be folded back, the mechanism is also folded and the canopy is placed on top of it. The

folded canopy is secured by straps. The canopy mechanism is attached to the rear bows by side straps. The door flaps are stored in a special bag in the luggage compartment.

Body lubrication. Every 6,000 km lubricate door hinges, hood hinges, door locks and limiter hinge by a 60 per cent solution of colloid graphite in white spirit or by engine oil.

The door dovetail female locks, door dovetail male and door lock bolt should be lubricated every 6,000 km either by a compound consisting of 30 per cent of natural wax, 60 per cent paraffine and 10 per cent graphite, or by a thin coating of grease.

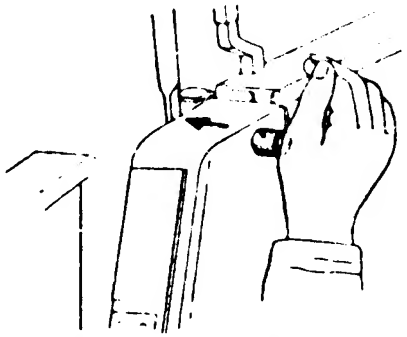


Fig. 43. Removal of Canopy Frame post

HEATING AND VENTILATION

The automobile is heated by hot water from the engine cooling system (Fig. 44). The water enters the special heater radiator mounted behind the instrument panel. The heater heats the air which is then forced into the body through a port located in front of the windscreen. The air is forced in by the oncoming air flow.

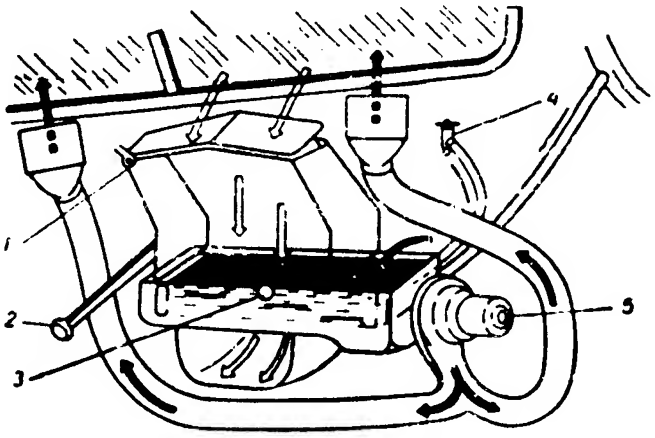
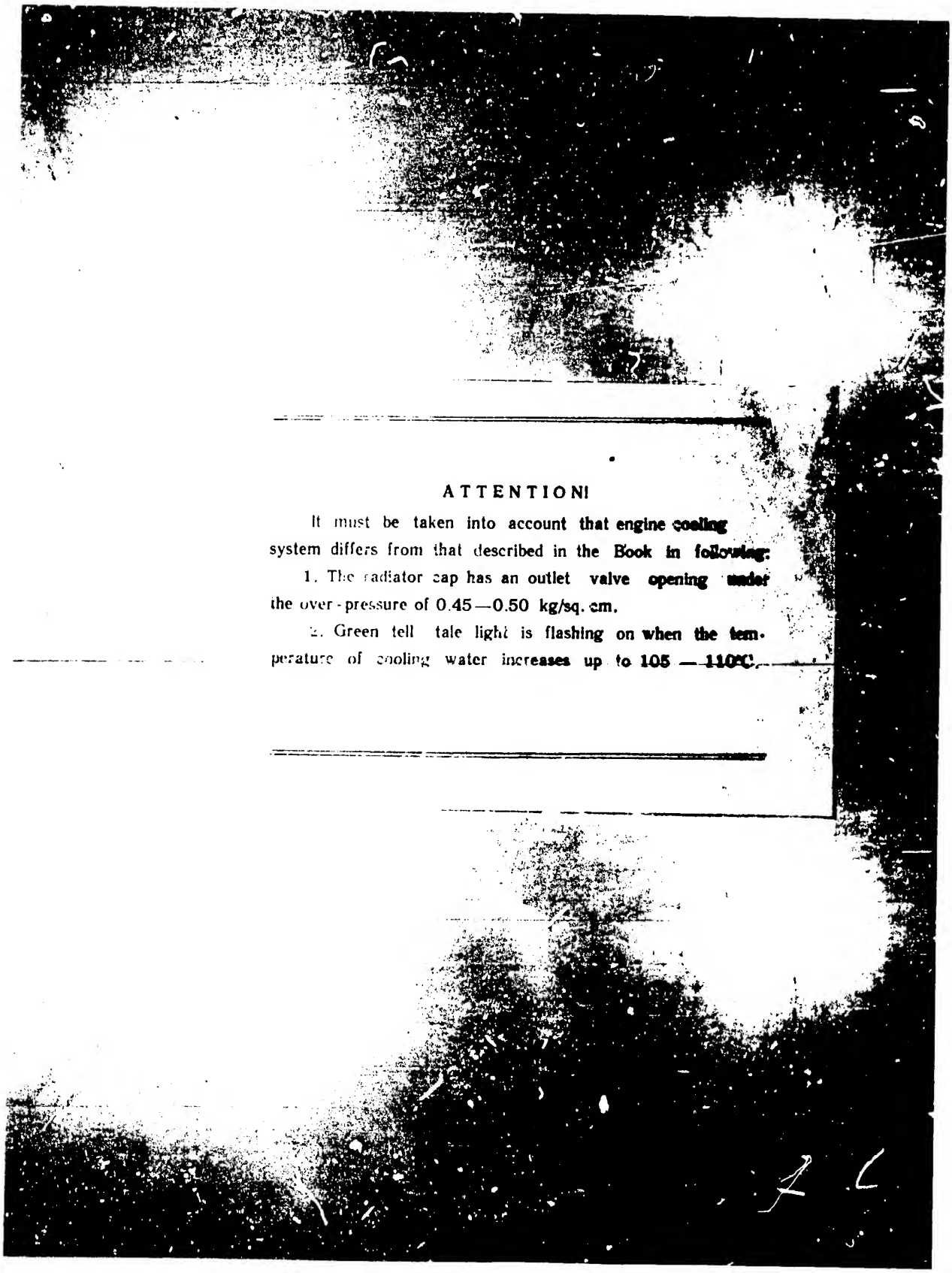


Fig. 44. Body Heating and Ventilation Diagram

1 — heater port, *2* — port handle, *3* — windscreen defroster ventilator motor switch, *4* — cock for control of delivery of hot water from cylinder head to heater radiator, *5* — windscreen defroster ventilator motor.

Temperature control inside the body is effected by opening the heater port and the water cut-off cock located on the engine cylinder head. Windscreen defrosting is ensured by warm air supplied by the electric ventilator. The ventilator motor switch has three positions: middle — off, left — low speed, right — high speed.



ATTENTION!

It must be taken into account that engine cooling system differs from that described in the Book in following:

1. The radiator cap has an outlet valve opening under the over-pressure of 0.45—0.50 kg/sq. cm.

2. Green tell tale light is flashing on when the temperature of cooling water increases up to 105 —110°C.

ПРАВИЛА ЭКСПЛУАТАЦИИ АККУМУЛЯТОРНЫХ СВИНЦОВО-КИСЛОТНЫХ СТАРТЕРНЫХ БАТАРЕЙ

типы батарей

TYPES OF BATTERIES

3СТ-60, 3СТ-70, 3СТ-84, 3СТ-98, 3СТ-112, 3СТ-126, 3СТ-135, 6СТ-42, 6СТ-54, 6СТ-68, 6СТМ-128, 6СТЭН-140, 6СТК-135, 6СТК-180

OPERATING INSTRUCTIONS FOR LEAD STARTER STORAGE BATTERIES

I. ЭЛЕКТРИЧЕСКИЕ ХАРАКТЕРИСТИКИ АККУМУЛЯТОРНЫХ БАТАРЕЙ

1. Электрические характеристики аккумуляторных батарей должны соответствовать данным, указанным в табл. 1.

Таблица 1

Типы батарей	Номинальное напряжение, V	Разрядный ток при 10-часовом режиме разряда, А	Емкость при 10-часовом режиме разряда и средней температуре электролита +30°С, Ah	Разрядный ток на стартерном режиме, А
3СТ-60	6	6,0	60	180
3СТ-70	6	7,0	70	210
3СТ-84	6	8,4	84	250
3СТ-98	6	9,8	98	295
3СТ-112	6	11,2	112	335
3СТ-126	6	12,6	126	380
3СТ-135	6	13,5	135	405
6СТ-42	12	4,2	42	126
6СТ-54	12	5,4	54	160
6СТ-68	12	6,8	68	205
6СТМ-128	12	11,2	112	360
6СТЭН-140	12	12,6	126	420
6СТК-135	12	12,2	122	340
6СТК-180	12	15,4	154	500

II. ПРИВЕДЕНИЕ БАТАРЕЙ В РАБОЧЕЕ СОСТОЯНИЕ

А. ЗАЛИВКА БАТАРЕЙ ЭЛЕКТРОЛИТОМ

2. В зависимости от климатического пояса, в котором работают аккумуляторные батареи, их заливают различными по плотности растворами серной кислоты, указанными в табл. 2.

Таблица 2

Климатический район	Плотность электролита при 25°С
Крайние северные районы с температурой зимой ниже 35°С	Зимой 1,31 Летом 1,27
Северные и центральные районы с температурой зимой до 35°С	1,27
Южные районы (в том числе Грозный)	1,25

3. Электролит для заливки аккумуляторов готовят из серной кислоты и дистиллированной воды. Температура электролита, заливаемого в батареи, должна быть по возможности 18—25°С и в крайнем случае не превышать 45°С.

4. Кислота должна быть высокого качества. При удельном весе кислоты в пределах 1,82—1,83 (при 20°С) содержание примесей в ней не должно превышать количеств, указанных в табл. 3.

5. Для приготовления электролита применяется стойкая к действию серной кислоты посуда (керамиковая, эбонитовая, свинцовая), в которую заливается сначала вода, а затем — при непрерывном перемешивании [illegible] веслом из кислотостойкого материала — серная кислота.

Вливать воду в [illegible] кислоту категорически [illegible] жание несчастных случаев от [illegible]

6. Рабочие, занятые [illegible] творов серной кислоты, [illegible]

должны работать в резиновых галошах, резиновых перчатках и резиновых фартуках. Глаза должны быть прикрыты защитными очками.

При случайном попадании брызг на лицо или руки работающего нужно осторожно снять кислоту ватой и быстро смочить это место водным раствором соды или аммиака.

Таблица 3

Наименование примесей	Содержание примесей, %
Марганец	не более 0.0001
Железо	» 0.012
Мышьяк	» 0.0001
Хлор	» 0.0005
Окислы азота (N_2O_3)	не более 0.0001
Вещества, восстанавливающие марганцево-кислый калий	не более чем 400 *мл* 0.01 N раствора $KMnO_4$ на 1 литр кислоты
Тяжелые металлы, осаждаемые сероводородом (кроме Pb и Fe)	не должно происходить изменения цвета, выпадания осадка

Б. ПЕРВЫЙ ЗАРЯД

7. Батареи, устанавливаемые на первый заряд, должны быть тщательно вытерты от пыли, а также от вазелиновой или тавотовой смазки (если ею покрыты [illegible] и выводные штыри). [illegible] в батареи 3СТ-70, 3СТ-90, 3СТ-126, 6СТ-68, 6СТК-135 и 6СТК-180 [illegible] тизирующие диски [illegible] обратно в батареи не ставятся). [illegible] рен заливают электролит до [illegible] 15 *мм* выше предохранительного [illegible] положенного над сепаратором.

В аккумуляторных батареях [illegible] 3СТ-135, 6СТ-54 и 6СТ-68 могут [illegible] крышки с вентиляционными отверстиями. [illegible] ред приведением таких батарей в [illegible] стояние удаляют трубочки, вставленные [illegible] тиляционные отверстия, ввертывают пробки, плотно надевают их на вентиляционные штуцеры и заливают электролит до уровня, который на 15—20 *мм* ниже верхнего края горловины.

После этого снимают пробки с вентиляционных штуцеров, и электролит в аккумуляторах опускается до нормального уровня.

8. По истечении 3—4 часов после заливки электролита, при температуре его не выше 50° С, батареи ставят на заряд. При температуре электролита выше 50° С ему следует дать остыть до этой температуры и только после этого батарею включить на заряд.

При возможности лучше начать заряд при температуре электролита не выше 25° С. Положительную клемму батареи присоединяют к положительному полюсу источника тока, а отрицательную — к отрицательному.

Таблица 4

Типы батарей	Зарядный ток, А		Объем электролита, необходимый для заполнения батарей, *л*
	Заряды		
	первый	последующие	
3СТ-60	3,5	5,0	2,3
3СТ-70	5,0	6,5	2,5
3СТ-84	6,0	8,0	2,7
3СТ-96	6,5	9,0	3,5
3СТ-112	7,0	10,0	4,0
3СТ-126	7,5	10,0	4,5
3СТ-135	7,5	10,0	5,0
6СТ-42	3,0	4,0	1,9
6СТ-54	3,5	5,0	2,3
6СТ-68	4,5	6,0	2,9
6СТМ-128	8,0	10,0	7,2
6СТЭН-140	8	10,0	7,5
6СТК-135	8	10,0	10,2
6СТК-180	10	12,0	10,8

...ях, при необходи-
...допускается уста-
...при условии, что
...трех часов после
...плотностью залива-
...той же температуре) не
...удельного веса.

9. Сила тока при первом и последующих зарядах, а также объем электролита, необходимый для наполнения батарей, указаны в табл. 4.

10. Заряд продолжают до тех пор, пока не наступит обильное газовыделение во всех аккумуляторах батарей, а напряжение и плотность электролита не останутся постоянными в течение двух часов. Напряжение контроли-

...руется
...деления в 0,0...
В любом случае длительность
быть не менее 5 час.

11. До начала заряда электролит...
...рают температуру
...тем, чтобы она не
В противном случае снижают
половину или прерывают заряд на
...ходимое для падения температуры
...лита до 30° С.

12. К концу первого заряда плотность
...троли...та должна быть такой же, какой
...залита батарея (при одной и той же
...туре, см. табл. 5).

Таблица 5

Плотность заливаемого электролита при температуре 20° С	Изменение плотности электролита в зависимости от изменения его температуры			
	+30°С	+40°С	+50°С	+60°С
1,31	1,305	1,295	1,290	1,280
1,27	1,265	1,255	1,250	1,240
1,26	1,240	1,235	1,230	1,220

Если плотность электролита будет выше, то электролит корректируют дистиллированной водой и продолжают заряд еще 30 мин. Затем батарею выключают, дают постоять не менее 30 мин и производят замер уровня электролита во всех аккумуляторах батарен.

Уровень электролита должен быть строго в пределах, указанных в п. 7 настоящих правил ухода. При уровне электролита в отдельных аккумуляторах или во всех аккумуляторах батареи ниже нормы добавляют электролит той же плотности, какой заливалась аккумуляторная батарея.

При уровне электролита выше нормы отбирают часть электролита резиновой грушей до требуемого уровня.

13. После первого заряда батареи заливают пробками, обтирают чистой сухой ветошью и сдают в эксплуатацию.

III. УХОД ЗА АККУМУЛЯТОРНЫМИ БАТАРЕЯМИ И ЭКСПЛУАТАЦИЯ ИХ НА МАШИНАХ

14. При эксплуатации батарей на машинах необходимо систематически:

а) очищать батарею от пыли;

б) очищать выводные клеммы батареи и наконечники проводов от окислов, не допускать смазывания межэлементных соединений и выводных зажимов вазелином или тавотом (за исключением зажимов с резьбовой нарезкой);

в) вытирать чистой ветошью поверхность батареи от пролитого на нее электролита. Ветошь предварительно должна быть смочена в растворе нашатырного спирта или кальцинированной соды (10-процентный раствор);

г) проверять плотность ...
в гнезде;

д) проверять ...
такта наконечников ...
клеммами батарей. Для ...
ки выводных клемм не ...
проводов;

е) проверять и при ...
щать вентиляционные ...

ж) проверять во всех ...
уровень электролита, который ...
строго в пределах, указанных в п. ...
правил ухода. При ...

[illegible] доливку аккумуляторов [illegible] дистиллированной водой, пока [illegible] примет нормальный уровень. В [illegible] время года, во избежание замерзания, [illegible] следует добавлять непосредственно перед [illegible] для быстрого перемешивания ее с [illegible] во время заряда.

Примечание. С целью предохранения [illegible] аккумуляторов батарей 6СТМ-128, 6СТЭН-140, 6СТК-[illegible] [illegible]-180 от разрушения рекомендуется их [illegible] подкрашивать или вытирать ветошью, увлажненной минеральным маслом.

15. Доливать электролит или кислоту в аккумуляторы воспрещается, за исключением тех случаев, когда точно известно, что понижение уровня электролита произошло за счет его выливания. При этом доливаемый электролит должен быть такой же плотности, какую имел электролит в аккумуляторе во время проливания.

16. Следить [illegible] торов на [illegible] та, [illegible] торов (см. [illegible]) [illegible] (при [illegible] 50% [illegible]

[illegible]		
у полностью заряженной батареи	у батареи, разряженной на 50%	[illegible] на 50%
1,310	1,[illegible]	1,[illegible]
1,270	1,[illegible]	1,[illegible]
1,[illegible]	1,170	[illegible]

[illegible]

I. ELECTRIC CHARACTERIST[illegible] ...TERIES

1. Electric characteristic[illegible] ...rage [illegible] ...ers in table 1.

Table 1

Type of battery	Nominal voltage, V	10-[illegible]		
3CT-60	6	[illegible]	[illegible]	180
3CT-70	6	[illegible]	[illegible]	210
3CT-84	6	[illegible]	[illegible]	[illegible]
3CT-96	6	[illegible]	[illegible]	[illegible]
3CT-112	6	[illegible]	[illegible]	[illegible]
3CT-126	6	[illegible]	[illegible]	[illegible]
3CT-135	6	[illegible]	[illegible]	[illegible]
6CT-42	12	[illegible]	[illegible]	[illegible]
6CT-54	12	[illegible]	[illegible]	[illegible]
6CT-66	12	[illegible]	[illegible]	[illegible]
6CTM-128	12	8.8	[illegible]	[illegible]
6CTЭH-140	12	11.2	[illegible]	[illegible]
6CTK-135	12	12.6	[illegible]	[illegible]
6CTK-180	12	[illegible]	[illegible]	[illegible]
	12	15.4	[illegible]	500

II. GETTING STORAGE BATTERIES READY FOR OPERATION

A. FILLING STORAGE BATTERIES WITH ELECTROLYTE

2. Depending upon the climatic zone in which the storage batteries operate, they are filled with sulphuric acid solutions of various density, as shown in table 2.

Table 2

Climatic region	Electrolyte density at 20° C
Extreme Northern regions with winter temperature below —35°C	in winter 1.31 in summer 1.27
Northern and Central regions with winter temperature to —35° C	1.27
Southern regions, the tropics included	1.25

3. The electrolyte for filling the storage batteries is prepared from sulphuric acid and distilled water. The temperature of electrolyte poured in the batteries should be +18 to +25° C and in any case it should not exceed +45° C.

4. The acid should be of a high quality. With specific gravity of the acid within 1.82—1.83 (at 20° C) the acid should not contain impurities in excess of quantities given in table 3.

Table 3

Impurity	Impurity percentage
Manganese	not more than 0.000[illegible]
Iron	not more than [illegible]
Arsenic	not more than [illegible]
Chlorine	not more than [illegible]
Nitrogen oxides (N_2O_5)	not more than [illegible]
Substances reducing potassium permanganate	not more than [illegible] 0.01 N solution of [illegible] per litre of acid
Heavy metals precipitable by hydrogen sulphide (except Pb and Fe)	no change of colour [illegible] sulfonaphthol [illegible] place

5. To prepare the electrolyte, use sulphuric-acid resisting containers (ceramic, hard rubber, lead). First pour the water and then, while continuously stirring by means of air or a paddle made of sulphuric-acid resisting material-pour in the acid.

Under no circumstances should water be poured into strong sulphuric acid, to avoid being scalded.

6. When preparing sulphuric acid solutions, the personnel should operate in rubber galoshes, rubber gloves and rubber aprons. The eyes should be protected with goggles. If acid is accidentally spattered onto the face or hands of the operator, carefully remove it with cotton wool and quickly moisten this place with a water solution of soda or ammonia.

B. FIRST CHARGE

7. The batteries which are installed for the first charge, should be thoroughly wiped of dust. Vaseline or grease with which intercell connectors and terminals are coated should be removed as well.

Prior to filling with electrolyte the batteries, types 3CT-70, 3CT-84 3CT-98, 3CT-112, 3CT-126, 6CT-42, 6CTM-128, 6CTЭH-140, 6CTK-135 and 6CTK-180, remove the sealing discs from under the vent plugs (these disks are not to be reinstalled). Then pour the electrolyte into the battery to a level 10—15 mm above the lower cover placed over the separators.

Types 3CT-60, 3CT-135, 6CT-54 and 6CT-68 batteries can have chamber covers with ventilation holes. Prior to preparing these batteries for operation, remove the [illegible] into the ventilation holes, turn off the vent plugs, put them on the ventilation unions and pour the electrolyte in up to a level 15—20 mm below the upper edge of the throat.

Then remove the vent plugs from the ventilation unions and the electrolyte in the battery will drop to the normal level.

8. In 3—4 hours after filling the battery with the electrolyte which should have a temperature not higher than 50° C, put the batteries on charge.

If the temperature of the electrolyte is higher than 50° C, it should be cooled down to this temperature and the battery then put on charge.

If possible, charge the battery with the electrolyte temperature not higher than 25° C. Connect the positive terminal of the battery to the positive lead of the supply source and the negative terminal—to the negative lead.

Note. In special cases the batteries can be filled for operation without preliminary charging provided that the electrolyte density, three hours after filling, drops by not more than 0.03 of density measurement unit as compared to the electrolyte density at the time of filling (at the same temperature).

9. The value of charging current during the first and the subsequent charges as well as the electrolyte volume required for the filling of the battery are given in table 4.

10. Continue to charge until all the batteries are abundantly gassing and the voltage as well

Table 4

Type of battery	Charging rate, A		Volume of electrolyte required to fill the battery, l
	Charges		
	first charge	subsequent charges	
3CT-60	3.5	5.0	2.3
3CT-70	5.0	6.5	2.6
3CT-84	6.0	8.0	2.7
3CT-98	6.5	9.0	3.5
3CT-112	7.0	10.0	4.0
3CT-126	7.5	10.0	4.5
3CT-135	7.5	10.0	4.8
6CT-42	3.0	4.0	3.0
6CT-54	3.5	5.0	3.8
6CT-68	4.5	6.0	5.0
6CTM-128	8.0	10.0	7.2
6CTЭH-140	8.0	10.0	7.5
6CTK-135	8.0	10.0	10.0
6CTK-180	10.0	12.0	10.0

as the electrolyte density remain constant for 2 hours.

The voltage is checked by a voltmeter having a 3 V scale with a 0.02 V scale division reading of accuracy class 1.0. In any case the duration of charge should not be less than 5 hours.

11. During the charge, periodically check the electrolyte temperature and see that it does not exceed +60° C. Otherwise, reduce the charging current by one half or stop to charge for a time to allow the temperature of the electrolyte to drop to +50° C.

12. At the end of the first charge the electrolyte density should be the same as it was while filling the battery at the same temperature (see table 5).

Table 5

Density of the electrolyte to be poured in at +20° C	Change of electrolyte density depending upon its temperature			
	+30° C	+40° C	+50° C	+60° C
1.31	1.305	1.295	1.290	1.280
1.27	1.265	1.255	1.250	1.240
1.25	1.240	1.235	1.230	1.220

If the electrolyte density is higher, add distilled water and continue to charge for 30 min more. Then switch off the supply current, let the battery rest for 30 min and measure the electrolyte level in all the cells.

The electrolyte level should be strictly within the limits given in p. 7 of present instructions. If the electrolyte level individual cells or in all the cells is below the normal level, add electrolyte having the same density as the electrolyte with which the battery had been filled. If the electrolyte level is higher than normal—pour off some of the electrolyte by a bulb to obtain the required level.

13. After the first charge, plug the batteries, wipe with clean, dry rags and put into operation.

III. MAINTENANCE OF STORAGE BATTERIES INSTALLED ON MACHINES

14. When operating the batteries on machines do as follows:

a) clean the battery of dust;

b) clean the battery terminals and wipe lugs from oxide, do not coat the intercell connecters and terminals with vaseline or grease (with the exception of threaded terminals);

c) wipe the battery surface with clean rags moistened with electrolyte, the rags should be previously moistened in a solution of ammonia spirit or soda ash (10% solution);

d) check the fastening of the battery in the box;

e) check the condition of the wire lugs with the battery terminals;

f) tighten the screws to avoid damage of the terminals;

g) check and if necessary clean ventilation holes;

h) check the electrolyte level in all the cells which should be within the limits given in p. 7 of these instructions. If the electrolyte level is lower than prescribed in p. 7 add distilled water into the battery cells to obtain the normal level.

During the cold seasons, to avoid freezing, add the water just before charging to ensure quick mixing of the water with the electrolyte while charging.

Note. To protect the wooden cases of types 6CTM-128, 6CTЭH-140, 6CTK-135 and 6CTK-180 batteries from damage it is recommended to coat them with paint periodically or wipe with rags slightly dipped in oil.

15. Never add electrolyte or acid into the batteries with the exception of cases when it is definitely known that the drop in level is due to loss of the electrolyte. The electrolyte to be added should be of the same density as the spilled electrolyte.

16. The batteries installed on machines should be always fully charged. If the density of the electrolyte indicates battery discharge (see table 6) greater than 25% in winter (at temperatures below zero) and greater than 50% in summer, remove the battery from the machine and send it to be charged.

Table 6

Density of electrolyte at 20° C		
fully charged battery	discharge to 50%	discharge to 25%
1.310	1.230	1.270
1.270	1.190	1.230
1.250	1.170	1.210

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